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Editorial

Applying Research Findings

THE Chippewa National Forest in Minnesota in a region where nature is none too cooperative with the timber grower, has become an outstanding example of applied forest management. Equally gratifying, the practices developed are being rapidly adopted on large industrial holdings in the state. Behind this lies an interesting story of wholehearted team-work between administrative and research foresters.

The Chippewa National Forest was placed under the administrative control of the U.S. Bureau of Forestry in 1902. Early silviculture was determined by acts of Congress which first reserved five and later ten percent of the merchantable trees for seed. The remainder was sold to lumbermen under contracts executed by the Bureau of Indian Affairs. Little opportunity for improved timber management existed until these contracts were fulfilled in 1923 and the land was formally transferred to the Forest Service.

Numerous inspections and short-term studies were made to determine the effectiveness of the seed tree cuttings, but organized research on a continuing basis did not get under way until 1929. By this time it was evident that seed trees had been effective in restocking only part of the cutover areas, plantation had given disappointing survival and mediocre growth, jack pine had failed to reproduce following cutting of sixty percent of the merchantable volume, and aspen was considered a weed tree of insignificant commercial value. What administrative officers declared they needed were formulas by which they could harvest jack pine and get red pine reproduction and harvest aspen and get white pine reproduction. Current practices were rapidly converting white pine lands to aspen and jack pine stands to brush. Moreover their confidence in the ability of research men to reverse this trend was meager. Nor were they in the least reassured when the research men began studying soils, natural forest succession, seed dispersal, seed bed requirements, drought resistance, tree diseases, insect pests, properties of aspen wood, and measuring light and soil moisture beneath forest and brush canopies.

One by one the research results were announced: Northern hardwoods are the natural climax on the Chippewa forest, Lake States conifers required about 20 percent light for continued survival and about 50 percent light for maximum growth. Light beneath mature aspen, red pine, and jack pine canopies is in excess of 20 percent. Brush canopies reduce light to about 5 percent. Root competition reduces growth beneath canopies but survival during drought periods is better in the shade of an overstory than in the open. Drought recurs so frequently as to be considered a normal hazard for every plantation. Drought resistance can be induced in nursery stock by appropriate hardening techniques. Low density in nursery seed beds, and properly fertilized beds produced seedlings larger in size, superior in survival, and more rapid in field growth rate than the nursery stock currently outplanted. Seed dispersal is meager beyond a distance of 100 feet from seed trees. Seedling establishment on mineral soil seed beds exceeds that on the undisturbed forest floor by as much as tenfold. Unopened jack pine cones up to eight years of age are a dependable source of viable seed. Decay in aspen begins to exceed growth at 60 years of age or earlier. Mortality in jack pine becomes heavy beyond 70 years of age. Red pine, properly spaced, grows at about 400 board feet per acre annually from its 55th to 140th year. Thinning in aspen, jack pine, and red pine improves growing conditions, decreases the time of the first merchantable cut and builds up stand resistance to normal vicissitudes of Minnesota forests. Aspen and jack pine woods have technical properties suitable for a number of commercial uses.

Such pronouncements, liberally documented by experimental evidence, impressed administrators, but in themselves led to more frustration than action. They enabled the research man to talk wise, but didn't inform the practitioner how to use this wisdom. Had the research workers stood on their findings the results might long have remained sterile information. Instead they began a new series of studies to demon-

strate that their knowledge could be applied. "Test tube" results were confirmed time after time under different conditions and finally expanded to small commercial-sized operations on experimental forests and elsewhere. Equipment was tested in systematic studies just as seedling growth or plantation survival. Here an enterprising supervisor met the research men more than halfway. He said in effect: "I will provide you the manpower and equipment if you will do the jobs on a large scale the way you think they should be done." Pilot experiments by the score resulted.

Research results on such a scale could no longer be ignored. The supervisor was quick to use these experiments in training schools where rangers and timber management officers were taught first hand by the research workers what it was difficult to acquire from reports. Results on the ground had added practical significance in that variations in results with deviations of conditions from the standard could be pointed out. and the fine points of practice emphasized. No longer were research findings isolated bits of information, but a kit of carefully fashioned working tools that the practitioner was taught to use. His long-neglected knowledge of ecology, plant physiology, and theoretical silviculture were drawn upon to explain why each step in the new operations was important. Ample consideration was given to equipment, efficiency, and costs as well as to performing a job in a manner that brought desired results. When difficulties were encountered by rangers, the research men gave generously of their time to explain techniques and when needed to install new experiments.

Confidence and mutual respect between the experimenters and forest personnel reached a high level. Together they planned new research and action programs. In 1940 came a real test of this team-work. Disaster followed on disaster, devastating insect outbreaks occurred on both hardwoods and conifers, a severe ice storm virtually wiped out the mature jack pine and a tornado levelled most of the old growth timber. Brush began to invade. Drastic action was required to save huge pine areas from a natural succession from brush to defective aspen to a hardwood climax dominated by hard maple, basswood, and birch, averaging at maturity only 30 to 40 feet in height and producing no merchantable timber.

The forest officers knew what they faced. Damaged timber was salvaged. Good seedbeds were prepared by heavy disk type plows that destroyed the brush. Natural seedling was supplemented by planted red pine. Today the scars are healed and many stands in better growing condition than before the disasters occurred.

Save for the variety of treafments the visitor is now scarcely aware of where the experimental forest operations leave off and the regular forest operations begin. The same high standards of silviculture prevail on both. Nor would he be sure in discussing the results from using herbicides to prepare brush lands for planting whether he was talking with a research man or a national forest officer. So intimate have relations become, and so promptly are research results put into practice, that experiment station men and forest personnel work as a single organization. With such impressive forest practice throughout the national forest it is not surprising that private timber companies hasten to do likewise. Here again the station workers gladly give of their time to spread good forest practice throughout the land.

Defining problems, fundamental studies to establish basic facts, small-scale tests under natural conditions, integration of results in pilot-scale operations, training schools for practitioners, and field service to overcome difficulties are the steps by which forest science can be brought to serve forest practice. Keen analysis of problems and synthesis of results, teamwork in practice and plenty of follow-through put technical forestry literally on the map.

Commercial Forestry in an Unstable Economy[1]

John A. Zivnuska

Instructor in forestry, University of California, Berkeley. Junior member, S.A.F.

Demand for lumber and consequent markets for sawtimber stumpage vary with business and with building cycles. Commercial sustained-yield forestry must be adjusted to such cycles. This has high significance to forestry enterprises, their overhead costs, and their capacity to furnish stable employment.

DUE TO the violently exploitative, migratory nature of the lumber industry in the past and the magnitude of the economic and sociological problems which have developed as a result, the attention of foresters and land economists has commonly been centered on the need for stable supplies of forest products. The importance of long-term trends in demand for forest products has been recognized, but only incidental attention has been given to the question of fluctuations in demand. It is the writer's belief that in the development of commercial sustained-yield units, whether privately or publicly owned, the cyclical instability of markets plays a more important and fundamental role than is indicated by the usual perfunctory statement that some adjustment in the rate of cut must be made to adapt the operation to good or bad market conditions.

Although preliminary investigation indicates that the cyclical problem occurs to some degree for all forest products, considerations of time and space make it necessary to limit this inquiry to lumber, which, since it constitutes 55 percent of the total volume of cut and a considerably higher percentage of the value of cut in the United States, is the dominant product of American forests. The possibility of cyclical analysis in the field of forestry is severely circumscribed by the types of data available. In this study it was found necessary to follow the somewhat indirect approach of determining the amplitude and frequency of fluctuations in lumber production, relating these fluctuations to cyclical movements in the general economy, and then evaluating the findings in terms of the economic characteristics of commercial forestry enterprises.

Analysis of Cycles in Lumber Production

For the statistical analysis of cycles it is essential to have data which are homogeneous as regards source, method of quotation, and coverage, and which extend over a sufficient period to include several cycles of the duration under study. Monthly series are preferable to annual series since the greater number of points enables more accurate analysis. Lumber production series which most nearly approximate these standards are the annual census reports adjusted for incomplete coverage by use of the decennial census data as benchmarks, covering the period since 1904, and the monthly Federal Reserve index of lumber production adjusted for seasonal variation, covering the period since January, 1919.

These two series were analyzed by the procedures developed during the comprehensive studies of business cycles carried on by the National Bureau of Economic Research under the leadership of Arthur F. Burns and Wesley C. Mitchell (*3*). Briefly, this method involves the elimination of any seasonal variation followed by the plotting of the series on a semi-logarithmic scale. Specific cycles are marked off directly on the basis of personal evaluation in accordance with certain necessarily arbitrary rules. These specific cycles are then treated as units of economic experience, each with its own base (thus eliminating the inter-cycle trend) and with the intra-cycle trend preserved. The series is also divided into reference cycles on the basis of reference dates of business cycles determined by the National Bureau of Economic Research. These two types of cycles can then be directly analyzed for such factors as timing, duration, amplitude, rate of change, secular movements, patterns, and conformity to business cycles.

Figures 1 and 2 show the two primary time series studied plotted on a semi-logarithmic scale and indicate the turning points at trough and peak of the specific cycles. Figure 3 shows a composite of the two series plotted on an arithmetic scale, and indicates the periods of expansion and contraction of the reference cycles. The more pertinent results of the detailed statistical analysis which was made are summarized in the following two paragraphs.

[1] This paper is a summary of portions of a dissertation entitled "Business Cycles, Building Cycles, and the Development of Commercial Forestry in the United States" submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the University of Minnesota, 1947.

Lumber production is a cyclical industry, in the sense that adjustment to business cycles represents a major economic problem for the industry. Production of lumber fluctuates directly with general business activity with an amplitude of movement which, though usually somewhat less than that of several other durable manufactures (with the notable exception of the disastrous contraction from August, 1929 to March, 1933), must still be considered large. The cycles have varied from two to seven years in length, but have usually lasted from three to four years. The annual data show an amplitude of expansion from initial trough to peak measured as a percentage of the average level of production during the cycle varying from 0.5 percent to 73.5 percent. With the exception of the violent expansions of 1921-23, 1932-37, and 1938-42, the expansions have been less than 10 percent of the average level of the cycle. The amplitude of contraction from peak to terminal trough measured on the same basis varies from 3.4 percent to 94.0 percent. Only the contractions of 1907-08, 1910-11, and 1923-24 have been less than 10 percent of the average level of the cycle, while contractions in excess of 20 percent have been usual. This tendency to a greater amplitude of contraction than of expansion is explained by the fact that the intra-cycle trend is downward in the majority of cases, thus emphasizing the contraction phase. The more sensitive monthly data show the same tendencies, but in even more pronounced form. The cycles have shown a marked, though not consistent, tendency to increase in intensity during the period covered by this study. Lumber has shown a limited tendency to reach its peaks a little later than business in general and to reach the turning point at the trough a little sooner than business. However, in the cycles of World Wars I and II lumber production reached its peaks and began to decline well before the turning points in general business. Both the expansion and contraction phases of the cycles have typically shown consistent development, with erratic contra-cyclical movements being of minor importance.

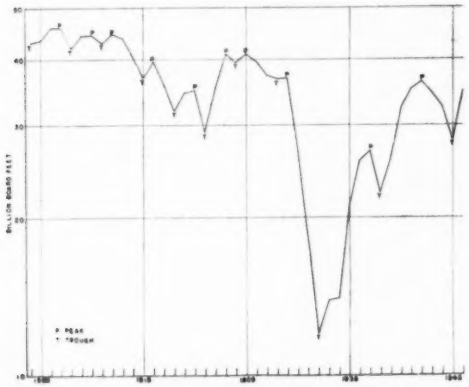

FIG. 1.—Annual lumber production, 1904-46.

In addition, the changing direction of the inter-cycle trend as shown by the average level of production during the specific cycles suggests the possible existence of a long-wave or secondary trend movement about a negatively sloping primary trend. The average yearly production of the full cycle fell from 44.5 billion board feet for 1904-08 to 33.3 billion board feet for 1919-21, rose to 39.0 billion board feet for 1924-27, fell to 20.3 billion board feet for 1932-38, and then began to rise again. The amplitude of contraction has usually been greater than that of expansion during the periods of downward inter-cycle trend, while the reverse has been true during the periods of rising inter-cycle trend. The total amplitude of the fluctuations to which lumber production has been subject is, of course, equal to the combined effect of the cyclical movements and these longer movements. For example, production in 1921 was 63 percent of that in 1907; production in 1925 was 141 percent of that in 1921; production in 1932 was 29 percent of that in 1925; and production in 1942 was 303 percent of that in 1932.

Basis of the Fluctuations in Lumber Production

The lumber industry provides a raw material for use in construction, in shipping, or in industrial fabrication. Thus, changes in construction and manufacturing activities and in the volume of shipments result in changes in the demand for lumber. These changes in demand in turn generate changes in the volume of production. In other words, cycles in lumber production are essentially reflections of cycles in the lumber consuming activities. As the first step in the analysis of this relationship it is desirable to consider the characteristics of the lumber industry which determine the extent to which production responds to changes in demand.

An analysis of available statistics of lumber production, wholesale prices, stocks, shipments, and orders plus a review of the various lumber

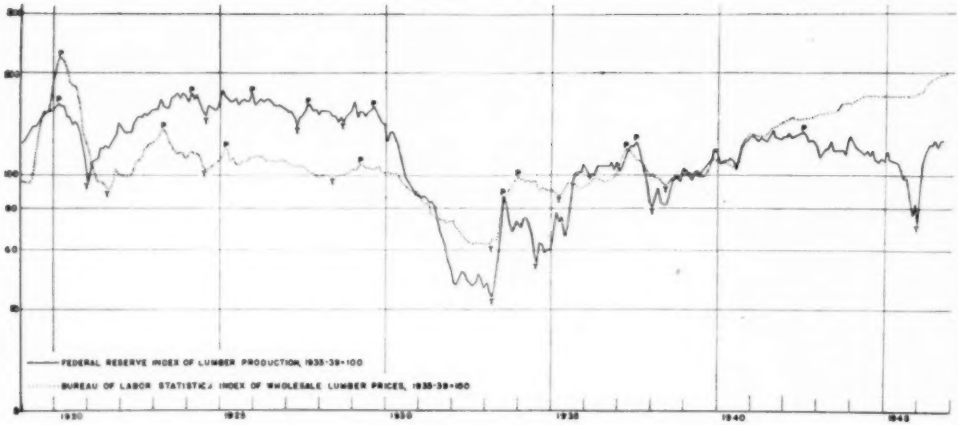

FIG. 2.—Lumber production and prices, monthly data, 1919-46.

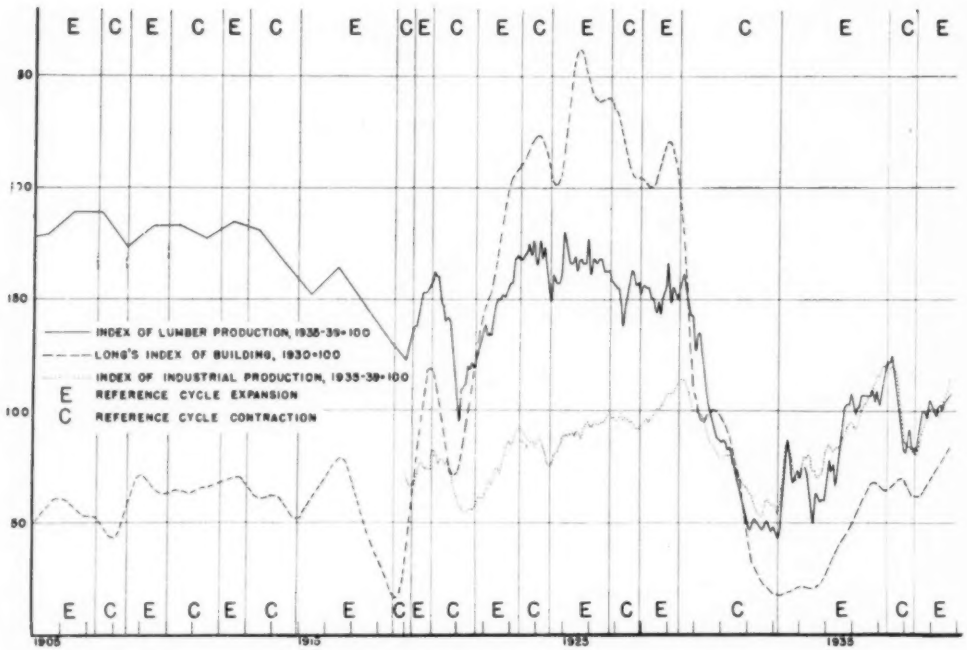

FIG. 3.—**Business cycles, building** cycles, and lumber production, 1905-39.

trade journals shows that, although each cycle had its own distinctive character, certain general relationships usually develop. As the period of expansion develops, production tends to anticipate rather than follow demand and stocks increase. Production usually, though not always, lags in its response to a decrease in demand at the end of the period of expansion, as is indicated by the relationship between production and wholesale prices shown in Figure 2. During the first part of the contraction even the curtailed production may continue to exceed demand. As the contraction continues production is forced below current demand by the falling prices and excess stocks. In some cases production begins to expand once again while the liquidation of stocks is still going on, but the evidence is not conclusive that this is the usual tendency.

Thus due to the economic pressures to produce (*6, 27*) and the ease of entry, the lumber industry is almost constantly plagued with the problem of adjusting supply to demand. Due to its tendency to overproduce its markets, lumber production has been a "feast and famine" industry, with short periods of high profits widely separated by prolonged periods of low profits or loss. Both the peaks and troughs in production tend to be more pronounced than the corresponding peaks and troughs in demand.

The problem remains of relating these fluctuations in demand which normally initiate the fluctuations in production to the general pattern of the American economy. The hypothesis advanced here is that these fluctuations are directly related to two forms of recurrent instability apparently inherent in our economy which are usually described as business cycles and building cycles. Business cycles consist of "expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years" (*3*).

Building cycles refer to a much more limited area of economic activity. The principal studies of building cycles (*15, 19, 20, 29*) have been based upon analyses of building permit data, and thus apply primarily to private residential, industrial, and commercial construction, alteration, and repair in municipalities large enough to require and maintain records of building permits. Two types of building cycles appear to exist: short cycles of about the same duration as business cycles which are superimposed upon long cycles with a duration of about fifteen to twenty years. Although the existing studies of building cycles show substantial differences in detail, analysis of these studies and of various supporting data indicates that the short building cycles and business cycles correspond roughly in timing, with building showing a tendency to lead business which is of questionable significance. Six long cycles which attained enormous amplitudes have been identified in the period 1830 to 1933. In historical order these cycles were approximately 13, 21, 14, 22, 18, and 15 years in length, giving an average of 17 years for all the cycles and of 18 years for the last three.

Since the relation of business and building cycles to the timing and amplitude of fluctuations in lumber production involves a problem of multiple causation complicated by the high degree of interdependence of the movements of the causal forces, any exact or mathematical determination of the relative importance of these factors appears impracticable. Instead, all that can be attempted here is an indication of certain broad relationships through the estimation of the relative volumes of lumber consumed by classes of use and an analysis of the relationship of each such class of use to either business cycles or building cycles.

Breakdown of Lumber Uses

Since detailed statistics of lumber consumption over a period of years have never been compiled, it was found necessary to develop rough estimates of the amount of lumber consumed in various uses between World Wars I and II on the basis of an analysis of a variety of reports of the U. S. Forest Service, the Lumber Survey Committee, the Bureau of Labor Statistics, and the Bureau of the Census. It was estimated that over a period of years in a time of peace domestic lumber consumption can be broken down on a percentage basis as follows: shipping, 17 percent; manufactures (excluding containers, millwork, and flooring), 10-12 percent; new nonfarm residential building construction, 25-30 percent; farm construction, including maintenance and repair, 15-18 percent; railroad construction, including maintenance and repair, 8-10 percent; all other maintenance and repair, 7-8 percent; private nonfarm nonresidential building construction, 6-7

percent; public buildings, 4-5 percent; other public works, 4 percent; and utilities other than railroads, 3 percent.

Although the United States has been on a net import basis for lumber during the last seven years, it has normally been a net exporter. Exports have usually amounted to about 6 percent of production, and imports to 3 percent. Exports, which depend on foreign market conditions, have usually expanded and contracted with total lumber production, but occasionally (particularly during the 1920s) have moved in contra-cyclical fashion. Imports, which depend on domestic market conditions, have fluctuated directly with production. The net effect is somewhat variable, but appears to be relatively unimportant in modifying the pattern of fluctuations in production.

The consumption of lumber in shipping fluctuates directly with fluctuations in the volume of goods produced and so can be expected to vary with business cycles. This is confirmed by analysis of estimates of lumber consumption in shipping (*16*, *26*), which also indicates that shipping requirements are less unstable than either total production or consumption (excluding the abnormal war years).

Household furniture, the primary manufacturing use of lumber, is a durable consumer's good, and as such its consumption can be expected to fluctuate with business cycles. The limited statistical data (*13*) support this view. The remaining consumption of lumber in manufacturing occurs in over fifty different kinds of industries (*25*) and so, from the nature of the concept, can be expected to vary with business cycles.

Since the ending of the period of rapid agricultural expansion about 1910, the consumption of lumber in farm construction has been determined increasingly by use in established agricultural areas for repairs, renovations, and replacements, with the establishment of new farms playing only a minor role (*12*). U. S. Bureau of Labor Statistics estimates of expenditures on farm construction for the period 1920-43 (*24*) show a one-to-one cyclical correspondence with business cycles, with the exception of the period 1923-29 in which the cyclical movements are not pronounced and the relationship is erratic. Such a cyclical correspondence appears consistent with the view expressed by T. W. Schultz (*22*) and others that the cyclical instability of agriculture's terms of exchange and so of income is initiated by expansions and contractions in business. That such correspondence is substantial but not complete is indicated by the correlation coefficient of +0.831 which John D. Black has found between farm income and national income for the period 1921-41 (*2*). Thus it appears probable that lumber consumption in farm construction tends to fluctuate with the more pronounced movements of business cycles, although occasionally showing some erratic movements due to special forces affecting agriculture.

Public construction includes both federal construction and state and local construction, with the latter having been substantially the more important of the two in the past.[2] Both types of construction have been sluggish in response to the shorter cyclical movements, but have shown marked differences in their response to more persistent economic fluctuations. Federal construction expenditures between World Wars I and II show a pronounced contra-cyclical pattern in relation to the major fluctuations, but state and local expenditures varied directly and sharply with these fluctuations. The over-all result was that public construction contributed directly to cyclical instability (*9*). Thus public construction requirements have also contributed directly to the more pronounced instances of cyclical instability in lumber production. The importance of state and local construction expenditures, the character of such construction, the diversity of the governmental units involved, and the financial problems of such units combine to indicate that the possibilities of converting this cyclical pattern to a counterweight program in the future are limited (*17*).

Lumber consumption by railroads can be expected to fluctuate directly with movements of business cycles. Railroad revenues are extremely sensitive to business conditions, while carloadings are a commonly used indicator of business activity (*7*). Railroad statistics show a marked tendency for expenditures on materials and supplies to reflect the fluctuations in revenue in intensified form (*30*).

Building Cycles and Lumber Production

Thus it appears that over a period of years usually slightly more than half of the total lumber production is consumed in classes of use which fluctuate in varying degree with move-

[2] For example, in the period 1920-36 state and local construction expenditures totalled 26.6 billion dollars, while federal construction amounted to 6.5 billion dollars (*4*).

ments of business cycles, but which lie outside the limited area of activity known to be directly involved in building cycles. The remainder of the consumption is for use in new construction and maintenance of nonfarm residential buildings and of private nonresidential buildings, all of which are activities which vary with the building cycle. Over half of this, or 25 to 30 percent of total lumber production, normally is used in residential building construction.

This importance of residential building construction is highly significant in analyzing the fluctuations in lumber production. Not only are the amplitudes of the long building cycles enormous, but also it has been shown by Long (*15*) that the long cycles in residential building have been of considerably greater amplitude than those in nonresidential building, while the cycles in alterations were only a third as severe as total new building cycles and a fifth as severe as residential building cycles. Studies of national income by Simon Kuznets (*11*) show that for the period 1919-35 the fluctuations in total construction were almost twice as great, in total private construction four times as great, and in residential construction (in which the value in the peak year was about 13 times that in the bottom year) nearly eight times as great as the fluctuations in consumers' outlay during the same period. Thus the increased dependency of the lumber industry on residential construction as its primary market which has developed since World War I represents a shift to one of the most notably unstable markets of the entire American economy.

The general relationship between business cycles, building cycles, and fluctuations in lumber production for the period 1905-39 is summarized graphically in Figure 3. Since the short building cycles and business cycles correspond roughly in timing, their combined effect is to produce a cyclical pattern in the demand for lumber with cycles of a duration corresponding to business cycles. More detailed analysis shows that in the majority of instances in which lumber production activity varied from general business activity such variation also existed in building. This indicates that the major cause of the divergences of lumber production cycles from business cycles (with the exception of the periods of World Wars I and II) has been the lack of perfect correspondence between short building cycles and business cycles. While both these important economic cycles affect lumber production cycles, their relative importance in explaining lumber cycles varies, depending on the general level of activity of each and the amplitude of their respective cyclical movements. During the 1920s when building activity was high relative to general business, lumber production was particularly sensitive to changes in building, while during the 1930s when building was low relative to business, lumber production fluctuated more closely with changes in business.

The importance of the long building cycle to lumber production has been recognized by Hallauer (*11*), who considers it as one of the important elements in determining the demand for lumber for nonfarm residential construction, and by Shames (*23*), who contends that it is the chief determinant of the major cycle in lumber demand.

While the importance of building in general and of residential building in particular as a lumber market plus the amplitude of the long cycles in these activities make it obvious that such long cycles are a factor of great importance in explaining the instability of lumber production, it does not appear that the existing data justify the conclusion that a long cycle is characteristic of lumber production or that the long building cycle is controlling in determining the pattern of lumber production. The forty-four years for which lumber production data are now available would cover at most a contraction phase, a full cycle, and an expansion phase of any such long-cyclical pattern. Clearly data of such limited coverage cannot provide an empiric basis for a hypothesis of long lumber cycles similar to that for business cycles which have been traced back over 30 consecutive cycles in the United States (*18*) or even to that for long building cycles which have been traced back over 6 consecutive cycles.

Moreover, careful study of the period for which annual production data are available fails to establish the existence of a long cycle-like movement corresponding to the long building cycle. Lumber production reached its all-time peak production in 1906-07, which was earlier than the generally recognized peak of the pre-World War I building cycle. In the following years while the building cycle culminated lumber production declined. This suggests that factors other than the building cycle were of equal or greater importance in determining the pattern of lumber production.

The post-World War I building cycle was of much greater amplitude than any of the earlier

cycles. This cycle began in 1918, reached its peak in 1925, and declined to its terminal trough in 1933 or 1934 (*15, 19, 20, 29*). However, both the monthly data and the annual data show a markedly lower level of lumber production in 1921 than in 1918. Furthermore, the specific cycle trough in lumber production which occurred in 1918 was due to war-caused production difficulties, not to any decline in demand (*1*). The trough in the long building cycle in 1918 must be recognized as coincidental, not causal. Analysis of the data on lumber production for long cycles by the methods of the National Bureau for Economic Research shows a long cycle from 1921 to 1932. The initial trough was three years later and the terminal trough one year earlier than the corresponding troughs in building. This 11-year cycle-like movement is marked off by two severe business depressions separated by a period of comparatively minor cycles in business activity. A roughly similar pattern to that of lumber production was shown in most forms of business activity during this period (*28*) so there does not appear to be any necessity of ascribing the lumber production pattern to any unique relationship.

In short, both business activity and building activity are major influences on activities in the lumber industry. The effect of either business cycles or building cycles on the lumber industry cannot be determined in isolation but must be considered with reference to activity in the other major source of influence on the cycles in lumber production. When the two forces move together in expansion or contraction the most pronounced periods of prosperity or depression result in the lumber industry. When business is rising but building is at a low level, conditions are not good, but are not extremely depressed. In a period of active building but moderately declining business, conditions are not good, but production may be fairly active.

Cyclical Problems of Forestry

Since the volume of timber logged on lumbering operations is closely correlated with production at the mill, the changes in volume of lumber production provide an accurate index to changes in the volume of sawtimber removed from the forest. Thus the fluctuations in lumber production are also fluctuations in the requirements for standing timber. The relationship of these fluctuations to business and building cycles which are known to have occurred continuously for a period extending over more than 150 years indicates that in the American economy the requirements for the products of commercial forestry enterprises engaged in growing sawtimber are inherently cyclically unstable.

Like business cycles, these cycles in requirements for standing timber are best thought of as "recurrent, but non-periodic, phenomena." While the above analysis establishes a strong presumption for continued cycles in timber requirements, the statistical evidence and knowledge of cycles at the present time does not provide a basis for exact predictions as to dates, durations, or amplitudes of such future cycles. These cycles, which have shown great variation in both amplitude and duration, have developed under the influence of business cycles, which "vary from more than one year to ten or twelve years" (*3*); short building cycles, which vary over the same range as business cycles; and long building cycles, which, while averaging 17 years in duration, have ranged from 13 to 21 years. While some complex systematic pattern of fluctuation may exist, it has not yet been determined. In the absence of such determination, the presumption is that cycles are non-periodic. Thus the existing state of knowledge justifies only the very generalized prediction that, to the extent that business cycles and building cycles develop in the future as they have in the past, cycles in the requirements for standing timber varying greatly in significance to the forest industries can be expected.

Due to the length of the production period in a forestry enterprise the problem of cyclical adjustment for such enterprises is distinctive. Since it takes a minimum of several decades to produce a forest tree of merchantable sawtimber size, it is impossible to make short-run adjustments in the quantity of standing timber corresponding to the cyclical changes in the requirements for such timber. Basically, the adjustment of commercial forestry to the cyclical changes in requirements must involve sustained production of sawtimber in a volume adequate to meet the requirements over a number of years including both cyclical peaks and troughs, with short-run adjustments to the cyclical changes through changes in the volume removed and not through changes in the volume produced.

As is shown in Figure 2, cyclical movements occur in the price of lumber, corresponding closely in timing with the cycles in lumber production. Since stumpage values are a residual element, the price of timber will fluctuate di-

rectly with the price of lumber and thus with cycles in lumber production and timber requirements. As a result, the cycles in timber requirements are accompanied in intensified form by cycles in gross income for the forestry enterprise.

In most industries production is varied during the course of the business cycle. In this way total production expenditures can be varied to some extent as gross income varies. As overhead or fixed costs increase relatively to total costs, the possibilities of such cyclical adjustment in production expenditures decrease. Thus the higher the overhead costs of an industry the greater the difficulty of adjustment to cyclical changes in demand and the greater the importance of a stable market (5).

In forestry, the length of the production period makes it necessary that production be maintained during the course of the cycles if it is to be carried on at all. Thus during the course of the cycles in timber requirements the costs of forest production are, with a few minor exceptions, almost entirely fixed costs in the sense that there is little internal possibility of their variation. As a result commercial forestry enterprises are confronted with the problem that costs continue at a relatively stable level during the cycles in timber requirements while gross income is subject to marked cyclical instability. Under such conditions successful management would appear to involve operation at a sufficiently high net income during the phase of high demand to offset operation at low net income or loss during the phase of low demand.

For financially strong enterprises such adjustments may be possible. It is evident, however, that substantial cyclical difficulties can be anticipated for private forestry enterprises. The problem is further aggravated by the fact that the lumber industry, which is the industry the most directly concerned with the production of sawtimber, is notably weak in financing and marketing, the very matters in which the problem of cyclical adjustment in commercial forestry requires a great deal of strength.

Adjusting Forest Operations to Cycles

While the cyclical changes in timber requirements can be expected to vary greatly from property to property, certain general considerations involved in the relation of cyclical adjustment to forest management are clear. A forest property organized and managed so that the net growth was equal to the requirements of the peak years would involve an investment in growing stock which would be excessive in all other years. A forest property organized and managed so that net growth was equal to the requirements of the trough years would be inadequate to meet the needs of all other years. The practical solution appears to be to attempt to organize and manage the property to produce a net growth adjusted to the trend in requirements, and to vary the cut in accordance with cyclical changes, overcutting the growth in years of high demand and undercutting in years of low demand.

In practice this is not a new concept. The forest manager has of necessity varied his cut. The point to be made here, however, is that, due to the recurrent nature of such fluctuations, definite provision for flexibility should be included in the plans for management. Such planning must consider more than provisions for changes in volume. It must be worked out with careful consideration of the requirements of the market for the particular forest property, of the financial circumstances and purposes of the enterprise, and of the quality, accessibility, and composition of the stands of which the forest is composed. The possibilities of varying the area which is logged as well as the volume cut in meeting the cyclical changes should be considered. The years of peak demand present an opportunity for improving the composition of the forest through cutting of the lower grade material and less valuable species, and also for the cutting of stands involving higher cost logging operations. Conversely, the desirability of income during years of low demand to meet the carrying charges may indicate that some stands of high grade, readily accessible trees should be held for sale during such periods. The advantages of such practices in stabilizing income are enhanced by the existing high level of income taxation.

In general, it appears that the conception of sustained yield should be modified to recognize the conditions of the American economy. The emphasis on equality of cut and net growth on an annual basis characteristic of much of forestry literature, however pertinent it may have been to the special conditions of highly protected, lumber importing countries of Nineteenth Century Europe, is inappropriate to American conditions. Due to the varying duration of the cycles, the simple substitution of a fixed number of years in the sustained yield formula is not an adequate solution. Instead,

sustained yield in the United States must be recognized as involving a running balance of cut and growth over a number of years including both cyclical peaks and troughs, with a considerable variation of the cut either above or below this average possible at any given point in time. The growth-drain ratio of a single year cannot provide a valid basis for decisions concerning the adequacy of management unless it can be shown that the cut of such a year can reasonably be considered as free from cyclical distortion.

Efforts to Control Cycles

It must, of course, be recognized that the reduction of such cyclical instability has become a widely, if not universally, accepted objective of government. Current economic and political literature is replete with hortatory appeals for the development of a stable economy with full employment and a high level of productivity. It is only through the success of policies designed for this purpose that solutions to cyclical problems can be developed. Other devices are at best only ameliorative. However, while the evaluation of such contra-cyclical policies lies wholly outside the scope of this paper, objectivity requires recognition of the fact that it remains to be demonstrated that such policies will be put into effect or will be effective if practiced. Since little evidence exists of the development of any ability to control cyclical instability during the last 150 years, and since currently advocated policies involve the checking of inflationary as well as deflationary tendencies, it appears to be the logical procedure to anticipate future cycles and to await the practical development of stability before basing thinking on terms of a stable economy.

Most of the policies now advocated for cycle control are fiscal in nature, and do not appear to involve direct effects on forestry. However, the frequent proposal for the development of a contra-cyclical pattern of public works, although usually advocated for its indirect effect through the action of the multiplier principle, would involve a direct replacement of private construction by public construction which might be of immediate significance to lumber production.

As was indicated in the earlier discussion of public construction, the development of such a program involves substantial difficulties which would probably limit its effectiveness. Furthermore, private construction is composed primarily of residential, manufacturing, commercial, and public utility projects, while public construction consists of highways, public buildings, public service, and conservation projects. Thus a shift from private to public construction is a shift to a type of construction having lower lumber requirements.[3]

If future contra-cyclical public construction programs should include large-scale housing projects as has sometimes been recommended, it is obvious that they would be of greater significance to the lumber industry and forestry. However, the social problem of housing requirements frequently conflicts with the needs of economic policy. Grebler (*10*) has shown that following World War I the government subsidized building programs in Germany and England tended to coincide with and accentuate business cycles rather than to mitigate them. The present government housing program in the United States, however justified, shows the same tendency.

Relation to Forest Policy

In the more immediate field of forest policy cyclical considerations are also pertinent. Since forestry enterprises are characterized by a tendency towards fixed costs and variable income during the course of the cycles, any policies which would convert fixed costs to variable costs would aid in the cyclical adjustment of the individual enterprise. This is, of course, only one of the many criteria by which policy proposals should be tested, and does not in itself lead to the advocacy of any particular policies. Since credit and taxation are among the more important charges on forestry enterprises, policies in these fields might well be examined from this standpoint.

Of the various special forest tax laws which have been proposed, the pure yield tax would give the greatest cyclical variation in tax charges. The modified yield tax would result in a substantial but not complete cyclical variation in tax charges. Of the proposals of the Forest Taxation Inquiry (*8*) only the deferred timber tax would result in any substantial cyclical variation in tax charges.

Recognition of the recurrent nature of the fluctuations in income from forestry enterprises also suggests the need for analysis of the feasi-

[3] Material orders for lumber and millwork per $1,000 of construction value are estimated at $44.63 for *all* construction during 1929, but at only $19.39 for all regular federal construction during 1934-38 and at $32.54 for P.W.A. financed construction during 1933-38 (*9*).

bility of providing for flexibility in the terms of repayment in the development of a program of long-term forestry credits. The failure to recognize cycles in timber requirements was one of the important sources of difficulties with many timber bond issues in which rigid amortization requirements frequently led to enforced liquidation for sale in glutted markets (*21*).

Basically, forestry, due to its long time nature, requires stability for its sound development—stability in ownership, in management, and in markets. Stable forest production is a necessary but not a sufficient condition for stable forest communities. A stable economy is also an essential concomitant of stable communities. Failure to recognize the problem of markets can only lead to disappointment in the sociological benefits resulting from good forest management.

Thinking in forestry must be in terms of the production period of forest trees. It is essential for sound analysis that such thinking be freed from the distortions of cyclical expediencies. Further studies of business cycles and building cycles which lead to the fluctuations in the demand on our forests should have much to contribute to the development of adequate perspective.

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Forestry Above the Mogollon Rim

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A concise picture of the management of a million acres of national forest timberlands.

THE Coconino National Forest is a far cry from the usual "cactus and rattlesnake" conception of Arizona. Trees from four feet to more than five feet in diameter are found on favored sites where they occasionally reach heights of nine (16 foot) logs. The normal range of sizes of mature trees is from 24" to 36" in diameter and from four to six logs in height. A traveler going through northern Arizona by train or automobile passes through only a scattered remnant of the stately forest that once surrounded Flagstaff. Here, before the turn of the century, loggers cut and burned over the most accessible forest areas. One does not realize that just over the horizon and continuing for 70 miles to the south stretches a great forest of ponderosa pine—over four billion board feet of it.

The pine country rolls gently with its low hills and shallow draws broken by only a few steep rocky ridges and deep rough canyons. The forest reaches unbroken to the Mogollon Rim—the great escarpment that marks the southern edge of the Colorado Plateau.

The Forest

Over most of the pine forest, both virgin and cutover, there is a good stand of reproduction brought about by a combination of heavy grazing which reduced grass competition, fire protection, and good seed years over the past forty years. Some seedlings are produced each year and each year a few survive, but the majority result from rare combinations of weather conditions and good seed years such as occurred in 1919 and to a lesser extent in 1909, 1913, and 1929. An over-abundance rather than a scarcity of reproduction seems to be characteristic of the forest except in local areas where heavy concentrations of livestock and deer have kept the pine seedlings nipped off. But the distribution by size classes is not ideal. Large poles are not as well represented as are younger age classes since they had to make their starts under more difficult conditions before the Forest Service brought fire protection to the scene.

The four hundred odd sections of virgin forest still remaining supports an all aged stand with most of the volume in mature "yellow pine" trees. It is these big yellow-barked trees of the virgin stands that must furnish most of the logs for the next four decades. After that the older cutover stands together with the larger "blackjacks" of the virgin stands will be ready for harvest.

As in most forests, the first problem is that of *protection*. Here the major protection problem results from fires set by lightning, the incidence of which is reportedly the highest in the country. The ten year average number of fires for the forest is over 475 with the southern edge, where most of the virgin forest lies, accounting for roughly half of the fires. A second and ever present problem wherever nature is disturbed is *erosion*. Sound slash disposal practices do much to alleviate both problems.

Managing the Forest

The forest has been on a sustained yield management basis for about 40 years, even though much of the more accessible forested land near Flagstaff was cut over and burned prior to the birth of the national forests in 1905. The management plan is revised every 10 years to adjust for changes in operating methods, economic conditions, and research findings. Some important changes in timber management have occurred since the formation of the national forests. The most notable of these is the shortening of the cutting cycle and proportionately increasing the residual stand or growing stock until now timber sale agreements guarantee to purchasers only 35 percent of the merchantable stand. This change from long to short cutting cycles is firmly founded on the results of research work done by G. A. Pearson and his associates at the Fort Valley Experimental Forest near Flagstaff.

Many foresters and loggers will consider the 35 percent cut too light. Here are the facts. The remaining four hundred odd sections of virgin forest contain many trees which die due to age, lightning, mistletoe, or disease each year. To cut over the remaining area of virgin forest as fast as is economically feasible is good forestry. First, it removes older aged trees from which most of the death loss comes. Second, it removes inferior trees so that the in-

creased growth comes on higher quality stems. Third, it rapidly extends the primary road system to all portions of the forest so that succeeding cuts can proceed more nearly according to silvical needs. And fourth, it makes all portions of the forest accessible by good roads, and establishes breaks minimizing the likelihood of disastrous fires.

Looking at the harvesting problem another way—cutting 35 percent instead of 70 percent of the merchantable volume means cutting two acres instead of one thus covering the whole area more quickly increasing the chances of salvaging dead and dying trees before they deteriorate. There is also an increase in net growth on the whole area since maximum growth occurs between the fifth and the fifteenth years after cutting. A cutting cycle which approaches fifteen years in length should, therefore, produce the greatest volume returns.

Another important factor is that logging in the area is not difficult. Over much of the forest, roads can be economically constructed and maintained. Almost any type of logging equipment can be used. Horses, tractors, tractors with arches, trucks and railroads are all being used successfully.

According to the available inventory figures (and they are not as good as might be desired) the virgin forest will be initially harvested in the late 1960's. A second harvesting cut will then be made on the same areas that are being cut today, removing approximately the same volume per acre that is being harvested this time. It will not be until the third cycle that the older areas from which 75 percent of the merchantable timber was cut will be harvested again. And it will be many decades before the pre-national forest cutover areas will enter the picture as more than a source of periodic and extremely light intermediate cuts. In addition to the intermediate cutting operations in the old cutover areas there are small sawmills cutting out the weak and dying trees in the virgin forest.

That is the general picture. A more complete understanding of the silvicultural and management situation will result from a brief examination of each of the three types of cutting that is being carried on simultaneously on the Coconino National Forest.

1. Initial harvesting in the virgin stands.
2. Light intermediate cutting in old cutover stands.
3. Mortality anticipation cutting in the virgin forest—far ahead of the initial harvesting operations.

The Harvesting Cut in the Virgin Stands

Under different ownerships the two large mills and several small ones in and near Flagstaff have been in practically constant operation for over 60 years. The first logging was done without regard for silviculture. Everything that was worth cutting was harvested and the slash was either set afire or allowed to burn unchecked when lightning started fires. This area, the most accessible to Flagstaff, now supports an average of less than 2,500 board feet per acre. In the early days of the national forests a seed tree system of marking was used. The area cut under this system also supports stands generally less than 2,500 board feet per acre. In the late 1920's the seed tree system gave way to a group selection system, under which approximately 75 percent of the volume was removed. During the late 30's the present system of individual tree or improvement selection evolved.

As the system developed, higher and higher percentages of the stand were reserved in order to keep larger growing stocks on the ground and to make the initial harvesting cut more quickly. In 1946 about 45 percent of the volume was reserved. In 1947 about 50 percent. And in future sales 60-65 percent will be reserved—much of it as "storage on the stump" against the next harvesting cut 20 years hence.

As the marking is now done each tree is considered individually.[1] Will it live? What are the risks involved? Will its removal release nearby trees to produce quality wood? Has it reached the physiological age when it is no longer a vigorous, fast-growing tree? Is it damaged, infested by mistletoe, or diseased so that it is no longer an asset to the forest? Is it producing low grade lumber and suppressing young clean-boled trees? If no sound reason for cutting the individual tree is found it is left to produce more wood and as "storage on the stump" for the next cut.

The regular cut from the virgin forest approximates 50 000 M. board feet annually. In 1946 and in 1947 this volume was cut from about 13 000 acres. In future sales about 17,000 acres will be harvested each year due to a lighter cut.

[1]Rotty, Roland. Some thoughts on forest management and the present Coconino marking policy. Jour. Forestry 44:962-964. 1946.

Intermediate Cuttings in Old Cutover Stands

Near Flagstaff where unregulated cutting was formerly practiced there are a dozen townships covered by grassland and scattered trees which are now reverting to timberlands. The few trees of unmerchantable size that escaped the axe and subsequent fires have reseeded a large part of the area. Now these residual trees are of merchantable sizes.

In early national forest days the seed tree method of marking for cutting was used. The seed trees were big healthy trees when they were left—perhaps 30 or 40 years ago. Now they remain as a scattered overstory of overmature trees.

Throughout the scattered stands in these two categories of old cutover timberlands there is, here and there, a tree that is dying. These trees, heavily infected by mistletoe, lightning struck, diseased, rotten, insect infested, or otherwise decadent, are marked for cutting and at the same time the stand is further improved by the removal of deformed or poor quality trees from young age-class groups. They are sold either to small mills or, during open winters, to the big mills as a supplement to the logs decked during the summer and fall. In 1946 these old cutover salvage operations cut from 166 to 442 board feet per acre or from 9.2 to 22 percent of the volume on a section.

One cannot help wondering if such low volumes can be made to pay. The mill operators apparently think so since they repeatedly bid for such areas when advertised for sale. A large mill manager told the writer a few years ago that in this type of country and with modern mobile equipment he could afford to cut and load single large trees. For the forest and the public such cutting has certainly paid. The silvical condition of the timber stands on these cutover lands has been improved. Trees that were destined soon to become snags added their products to a market badly in need of lumber. And the public purse benefitted through sale of the trees.

Mortality Anticipation Cutting in the Virgin Forest

Mortality anticipation cutting is done in the virgin forest only when it can be done far enough ahead of the initial harvesting operation so that the volume of timber cut will be replaced by growth of trees now of sawtimber sizes before the regular operations reach these stands. These operations harvest trees which it is anticipated will be dead before the initial harvesting operations are made. Overmature trees that are already dying, heavily mistletoe infected trees, insect infested trees, lightning and fire damaged trees and trees with *Cronartium* rust so far advanced that death will likely occur before the regular operation arrives, are harvested. The cut in these operations amounts to 18-20 percent of the stand and averages about 2 M. board feet per acre.

Under the "Sanitation" clause of timber sale agreements not to exceed two trees per acre may be removed purely for the benefit of the stand. The trees removed are mainly deformed, rotten or diseased trees that won't pay their way now or later—they just take up space.

Mortality anticipation cutting is not in a strict sense an improvement cutting since there is no attempt to remove merchantable trees of low quality or to release crowded groups—except where removal of trees that are soon to die accomplishes this. The objective is to cover as many acres as possible and salvage as many trees as possible that would otherwise be lost due to mortality.

There are at present three small mills with a combined capacity of about 10,000 M. board feet per season operating in overmatured stands ahead of regular harvesting operations.

Slash Disposal

Methods of Slash disposal are undergoing radical changes. Purchasers in the past were required to dispose of logging slash (1) by piling and burning along roads and(2) by lopping and scattering on areas not adjacent to roads. From a fire protection standpoint the large volumes of heavy fuel—snags, cull logs, limbs, and bark—along roads rendered the roadside strips where piling and burning had taken place relatively ineffectual as barriers from which to fight large fires. So the Forest Service took over snag falling and brush disposal. The present system used is this. All permanent roads and strips located at strategic intervals from the standpoint of fire control, are selected for a thorough cleanup job. "Dozers" with bunching teeth move inflamable dry fuels, and especially heavy fuels, into piles for burning.[2] A small follow-up crew of hand workers completes the cleanup. The result is a fuel-free firebreak 200-

[2] Colville, Leslie L. Development and use of Forest Service slashbunching teeth. Jour. Forestry 44:89. 1944.

250 feet in width from which a large fire can be successfully fought. Elsewhere slash is scattered on steep hillsides and used to plug skid trails to prevent erosion. Over the rest of the area tops, branches and snags are left as they fall. These tops interfere less with grazing and other forest uses than does the scattered brush, and the new fire lines are far better insurance against widespread conflagrations.

Timber Stand Improvement Work

Under the Knutsen-Vandenburg Act of June 9, 1930 the Forest Service is authorized to withhold for improvement work within the stand from which stumpage revenue is derived a portion of the sale price of the timber cut. With funds from this source the Forest Service is doing pruning of pole size trees to improve the quality of future timber crops. Approximately 100 well-spaced potential crop trees per acre are selected for pruning. Most are pruned to the height of the first log. Pruning higher on the tree is not economically feasible since the cost of pruning increases rapidly with the height above the ground.

Summary

On the Coconino National Forest the harvesting program is geared to salvage as many trees as possible over as large an area of the virgin forest as economies permit. At the same time stands are put in greatly improved silvical condition. The short cutting cycles and light improvement cuts are designed to stop excessive mortality, to increase growth, to improve the stand and to prolong the cut from virgin stands till the older, heavier cut, areas are again ready for harvest. These objectives are aided by special operations far ahead of the initial harvesting cut that removes trees likely to die soon. The cut from these two sources in the virgin timber is supplemented by intermediate cutting in old cutover stands where it will be many years before another regular harvesting cut can be made.

Slash disposal is handled by the Forest Service to give the greatest possible aid in eliminating disastrous fires and to prevent excessive erosion as a result of timber harvesting. Pruning is done in the pole stands to improve the quality of the future product of the forest.

Abstract of Master's Thesis

Transfer—A Training Technique in Administration. John Fedkiw. 112 pages of double-spaced thesis paper, bound. 3 illustrations. 1948.

TRANSFER of personnel to new areas of activity and to different responsibilities is a training technique frequently used by large organizations such as the Forest Service, Soil Conservation Service, Sears, Roebuck and Company, the Bell Telephone System, and many other public and private enterprises in developing leaders for higher administrative positions. Transfer derives its principal training values from its broadening influence on the growth and development of leaders. Its use, however, is often conditioned by considerations of greater importance in the attainment of the objectives of organization. Vacancies are the determinant factor in the movement of personnel. The values of a vacant position as a training situation for a potential transferee is subordinate to the requirements of the job and the need to recognize meritorious services through promotion. Nevertheless, transfers are desirable and valuable training experiences for men who are destined for leadership positions. Furthermore, they can be closely coordinated with the more important considerations and effectively applied in training administrators.

Some Strength Properties of Second-Growth Douglas Fir

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Increasing use of second-growth Douglas-fir focuses interest on the physical properties of such wood in relation to those of old-growth timber. Test data are presented on specific gravity, modulus of rupture, and modulus of elasticity of wood samples sawn from various heights and radial zones from three sample second-growth trees grown on Sites II, III, and IV.

THE Douglas-fir region in Oregon and Washington west of the summit of the Cascade Range supplies about 30 percent of the lumber cut in the United States. In addition, these forests contribute large amounts of pulpwood, poles, shingles, and plywood. As of 1945, the virgin sawtimber in this region covered 9,000,000 acres while second growth, chiefly Douglas-fir, covered more than 11,000,000 acres. Second-growth timber is rapidly becoming an important component of the cut of this region and will become increasingly more important as old-growth sawtimber becomes depleted.

The Pacific Northwest Forest and Range Experiment Station has recently published a compilation of the best known methods of managing these second-growth forests to attain maximum productivity.[2] In addition to recognizing principles of management based on the attainment of maximum volume productivity, consideration should also be given to the properties of the wood produced by second-growth stands. In recognition of this fact, studies of the quality of second-growth Douglas-fir have been initiated by the Forest Products Laboratory within the last two years.

Although ample data are available on the strength properties of old-growth Douglas-fir, the question arises as to whether these strength properties are applicable to second-growth timber. From the standpoint of management, it would be highly desirable to know the influence of position in the tree, with respect to distance from the pith as well as height above ground, and of age of the tree on these same properties.

With these questions in mind, the authors initiated this study in 1941 at the University of Washington in Seattle. Preliminary data were collected and the gathering of further data at a later time was contemplated. Unfortunately, the war intervened and the residence of the authors was changed, precluding the possibility of continuation of the study. The results of this preliminary study are submitted neither as a complete answer to these questions, nor as a predicting mechanism. It is felt, however, that these results show certain qualitative relationships, which, if found by others to be valid, may have an important bearing on the management and use of second-growth Douglas-fir timber.

Collection of the Data

One representative tree was selected from each of three sites on the Charles Lathrop Pack Demonstration Forest at La Grande, Washington. A description of the trees follows:

Site quality	D.b.h.	Total height	Age
	In.	*Ft.*	*Yr.*
II	23.7	156	137
III	18.5	130	111
IV	16.4	111	106

These trees were selected from the dominant or co-dominant crown classes in stands of average stocking in an attempt to represent typical growth for each site. The trees were felled, bucked into 8-foot bolts, each of which was sawn into two planks taken along the average diameter, and reduced to standard 2 inch by 2 inch by 30 inch specimens for testing at the University of Washington. A standard stem analysis was made of each tree, and a record was kept of the position within the tree from which each test specimen was taken within its respective 8-foot section. Three zones out from the pith were recognized, the midpoints of these zones being 2½, 5, and 7½ inches from the pith along

[1]Acknowledgment is made to Duane M. Covington, resident manager of the Pack Demonstration Forest, University of Washington, for his cooperation in supplying test material and to Prof. Walter H. Meyer, Yale School of Forestry, for helpful suggestions as to the statistical analysis. The writers also acknowledge the assistance of Charles Alexander and Donald Stubb who aided in the compilation of data while enrolled as students at the University of Washington College of Forestry.

[2]Management of second-growth forests in the Douglas-fir region. Douglas-fir Second-growth Management Committee, Pacific Northwest Forest and Range Experiment Station. 1947.

an average radius. These zones were designated as Zones 1, 2, and 3, respectively. A central zone extending 1¼ inches out from the pith was discarded in all tests.

Laboratory Testing of the Material

Within the various 8-foot bolts for each tree, all specimens meeting American Society for Testing Materials requirements for defect-free material were selected for test in a green condition.[3] The rough-sawn specimens were bulk-piled under cover in an outdoor shed during a brief period of storage, and were planed to exact size immediately prior to testing. Care was taken to maintain all specimens above 24 percent moisture content. Standard static bending tests were conducted from which modulus of rupture (bending strength) and modulus of elasticity (stiffness) were calculated. Specific gravity, based on oven-dry weight and oven-dry volume, was also determined.

In the preparation of test material it was discovered that a considerable number of specimens from the Site III tree were characterized by spiral grain. This material was nevertheless tested and the slope of grain determined for each individual specimen. Strength properties, calculated directly from test data, were then adjusted upward to correspond to an acceptable slope of grain of 1 in 20.[4] The authors performed all of the tests themselves but received aid in office compilation from student assistants provided through the National Youth Administration.

Calculated values of specific gravity, modulus of rupture, and modulus of elasticity for each of the three trees tested are shown in Table 1. Average values are presented individually by the three site-quality-classes for the different heights above ground and zones out from the pith.

Effect of Position in Tree

Due to missing values within the height-zone subclasses, taking the three trees as a whole, only Zones 1 and 2, and heights up to 54 feet, were included in an analysis to determine differences between trees, zones, and heights in their influence on the properties of the wood. These limits included 172 specimens.

Since data for all three properties tended to conform more closely to a log normal distribution than to a normal distribution, all basic data were transformed to logarithms. A standard analysis of variance was computed for the three properties after making an allowance for unequal numbers of test specimens within each subclass according to the method of expected subclass numbers.[5] The results of the analyses of variance were comparable for the three properties. The difference between trees was found to be highly significant.[6] This, however, cannot be interpreted as indicating a highly significant difference between site-qualities due to the fact that only one tree from each site was tested, thereby precluding the possibility of segregating the variation within trees of a particular site quality. The difference between Zones 1 and 2 was likewise found to be highly signicant, indicating that density, strength, and stiffness increased outward from the pith. There was also a highly significant difference between the values for each property at various heights above the ground.

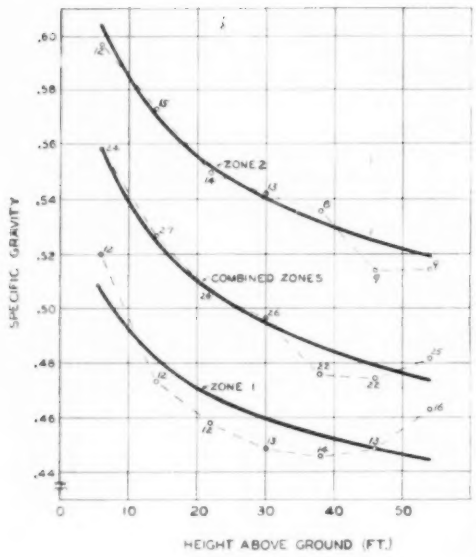
The variation in these properties at different heights above the ground was segregated into that due to linear regression and that due to deviation from regression. Regression was found to be highly significant, and deviations from regression nonsignificant, for the two zones as a whole. Regression equations were computed and after being transformed from logarithmic to arithmetic values, were plotted as shown in Figure 1, a, b, and c. The data and regression curves for each zone are portrayed separately. Since the first order interaction of zone x height was not significant, the assumption was justified that the same type of regression curve determined for the combined zones would apply to the individual zones. There is no statistical indication that a different type of regression curve is needed, even though in certain instances, namely, specific gravity and modulus of rupture for Zone 1, the basic data do not appear to conform to the regression line. None of the other first order or second order interactions, including trees x heights, trees x zones, and trees x heights x zones, was found to be signifi-

[3]Testing procedures corresponded to those outlined in A.S.T.M. D 143-27, "Standard Methods of Testing Small Clear Specimens of Timber."

[4]Adjustment was made on the basis of data presented in Table 18, U. S. Dept. Agric. Tech. Bul. 479, "Strength and Related Properties of Woods Grown in the United States."

[5]Snedecor, George W. Disproportionate subclass numbers in tables of multiple classification. Research Bulletin 180, Agric. Expt. Station, Iowa State College of Agric. & Mech. Arts. 1935.

[6]"Highly significant" as used hereafter is significance at or above the one percent level, while significance at the 5 percent level is considered "significant."



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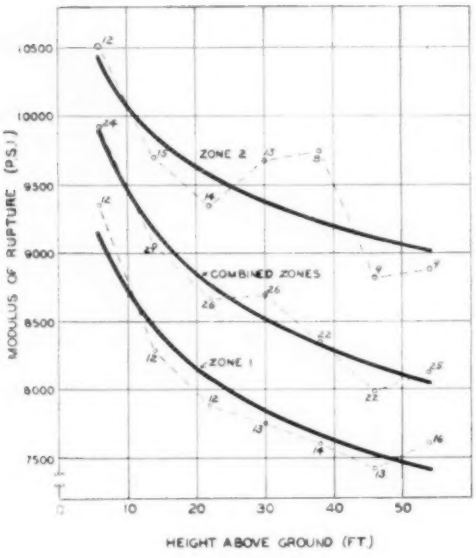

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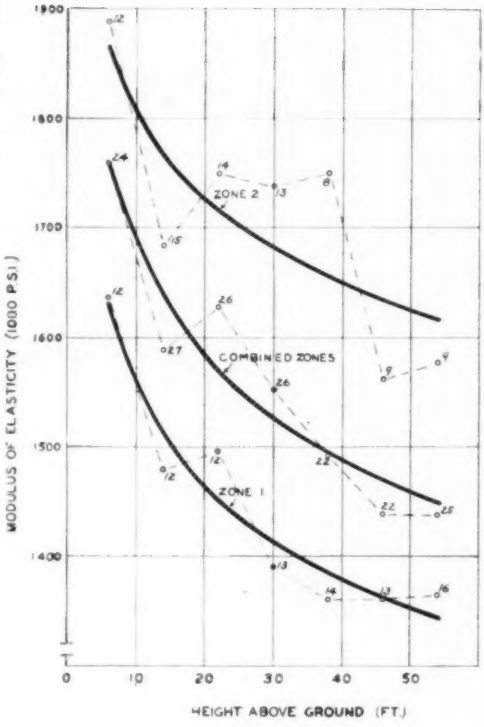

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FIG. 1.—Effect of distance from pith and height above ground on the properties of second-growth Douglasfir: (a) specific gravity, (b) modulus of rupture, (c) modulus of elasticity.

TABLE 1.—STATIC BENDING PROPERTIES OF SECOND-GROWTH DOUGLAS FIR TIMBER AT VARIOUS POSITIONS IN THE TREE

Tree	Property	Height above ground (ft.) 6 Zone 1	6 Zone 2	6 Zone 3	14 Zone 1	14 Zone 2	14 Zone 3	22 Zone 1	22 Zone 2	22 Zone 3	30 Zone 1	30 Zone 2	30 Zone 3
Site II	Specific gravity	.490	.575	.665	.452	.542	.625	.450	.510	.515	.418	.522	.610
	Modulus of rupture, p.s.i.	8600	9775	12460	7927	9602	11940	7810	8347	9655	7017	8972	11650
	Modulus of elasticity, 1000 p.s.i.	1586	1677	1590	1490	1635	1555	1667	1682	1602	1444	1702	2075
	Number of tests	3	4	2	4	4	2	4	4	2	4	4	2
Site III	Specific gravity	.534	.580		.490	.573		.458	.550		.448	.542	
	Modulus of rupture, p.s.i.	9760	10772		8517	9640		7580	9672		7854	9970	
	Modulus of elasticity, 1000 p.s.i.	1620	1956		1378	1646		1346	1634		1255	1610	
	Number of tests	5	4		4	6		4	6		5	5	
Site IV	Specific gravity	.530	.645		.482	.600		.470	.595		.485	.585	
	Modulus of rupture, p.s.i.	9440	11022		8430	9898		8375	9920		8435	10075	
	Modulus of elasticity, 1000 p.s.i.	1715	2058		1597	1804		1508	2061		1530	1956	
	Number of tests	4	4		4	5		4	4		4	4	

Tree	Property	38 Zone 1	38 Zone 2	46 Zone 1	46 Zone 2	54 Zone 1	54 Zone 2	62 Zone 1	62 Zone 2	70 Zone 1	70 Zone 2	79 Zone 1	79 Zone 2
Site II	Specific gravity	.422	.522	.417	.530	.474	.525	.422	.525	.415	.490	.430	.520
	Modulus of rupture, p.s.i.	7284	9442	7297	8982	7956	9172	7396	9740	7044	8750	7531	9291
	Modulus of elasticity, 1000 p.s.i.	1348	1760	1395	1640	1452	1663	1406	1719	1235	1555	1345	1677
	Number of tests	5	4	3	4	5	4	4	4	4	4	4	4
Site III	Specific gravity	.454	.545	.466	.480	.450	.495	.465	.493	.444			
	Modulus of rupture, p.s.i.	7346	9705	7046	7967	7333	8450	8280	9080	7860			
	Modulus of elasticity, 1000 p.s.i.	1316	1628	1345	1314	1255	1344	1340	1399	1310			
	Number of tests	5	2	5	3	6	2	4	3	5			
Site IV	Specific gravity	.470	.560	.454	.540	.474	.527	.478		.485			
	Modulus of rupture, p.s.i.	8437	10475	7922	9840	7992	8890	8360		7535			
	Modulus of elasticity, 1000 p.s.i.	1490	1868	1352	1860	1459	1657	1443		1484			
	Number of tests	4	2	5	2	5	3	5		2			

Tree	Property	89 Zone 1	89 Zone 2	99 Zone 1	99 Zone 2	109 Zone 1	109 Zone 2	118 Zone 1	118 Zone 2	126 Zone 1	126 Zone 2
Site II	Specific gravity	.440	.525	.462		.455		.458		.460	
	Modulus of rupture, p.s.i	7728	9652	7818		8172		8179		8260	
	Modulus of elasticity, 1000 p.s.i.	1351	1680	1243		1268		1286		1322	
	Number of tests	3	4	4		4		4		1	

eant. Thus, although the difference between the three trees was highly significant, non-significant interactions allow a grouping for at least qualitative comparisons. It may then be said that specific gravity, modulus of rupture, and modulus of elasticity increase outward from the pith and decrease with increasing height above the ground. Data for the three trees indicate that average specific gravity of the cross section decreases at a uniform exponential rate from approximately 0.56 at 6 feet above the ground to 0.47 at a height of 54 feet. The greater density of the zone 5 inches from the pith as compared with that 2½ inches from the pith, amounting to approximately .08, is maintained nearly uniformly throughout this range of height (6-54 feet).

Similar trends are indicated for modulus of rupture and modulus of elasticity, except that the differential between the two zones tends to increase slightly with increasing height above ground. Data for the combined zones in modulus of rupture show a regular exponential decrease from 9900 pounds per square inch (p.s.i.) at 6 feet to about 8000 pounds per square inch (p.s.i.) at 54 feet, and in modulus of elasticity from 1,760,000 pounds per square inch at 6 feet to 1,450,000 pounds per square inch at 54 feet.

$$\text{Specific strength values, } \left(\frac{\text{strength property}}{\text{specific gravity}}\right),$$

for modulus of rupture and modulus of elasticity were computed for various heights and zones from the curved values shown in Figure 1. The computed values shown in Table 2 are so nearly constant for each property that it appears, on the basis of the data presented, that the quality of cell wall substance was substantially unaffected by position in tree. For these data, at least, specific gravity may be used as a criterion of the properties at various positions in the tree bole.

For comparative purposes, standard procedure calls for tests to evaluate the mechanical properties of a species to be made on the second 8-foot bolt taken above stump height. This corresponds to data designated in this study as applying to material at an average height of 14 feet above the ground. A comparison of the results obtained in this study of second-growth Douglas-fir with published values for old-growth fir is presented in Table 3. Values obtained from each tree for specific gravity, modulus of rupture, and modulus of elasticity are shown together with average values for the three trees, as well as the probable values read from the curves of Figure 1 at a height of 14 feet. It is evident from the table that the second-growth Douglas-fir tested compares favorably with old-growth timber in specific gravity and static-bending strength properties.

Effect of Age of Tree at the Time of Wood Formation

The data were segregated for the three properties by various heights above the ground up to and including 70 feet, and by 20-year age classes as shown in Table 4. The age at which the wood at the midpoint of each test specimen was laid on the tree by the cambium was determined by reference to the stem analysis sheets. Due to the fact that many subclass values were missing when individual trees were segregated on this basis, statistical analysis was not possible. The data of the three trees were combined and logarithmic curves fitted to the data as shown in Figure 2, a, b, and c. It is realized that by combining the three trees, the difference between which is highly significant, only qualitative trends are indicated by this family of curves. However, by plotting the prop-

TABLE 2.—STRENGTH-SPECIFIC GRAVITY RATIOS AT VARIOUS POSITIONS IN TREE

Height	Modulus of elasticity		Modulus of rupture		Specific gravity		Modulus of elasticity / Specific gravity		Modulus of rupture / Specific gravity	
	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2	Zone 1	Zone 2
Ft.	1000 p.s.i.	1000 p.s.i.	p.s.i.	p.s.i.						
6	1625	1862	9110	10400	.506	.603	321	309	180	172
22	1452	1714	8080	9570	.468	.552	310	311	173	174
38	1385	1655	7660	9230	.453	.531	305	312	169	174
54	1343	1617	7400	9010	.444	.519	303	311	167	174

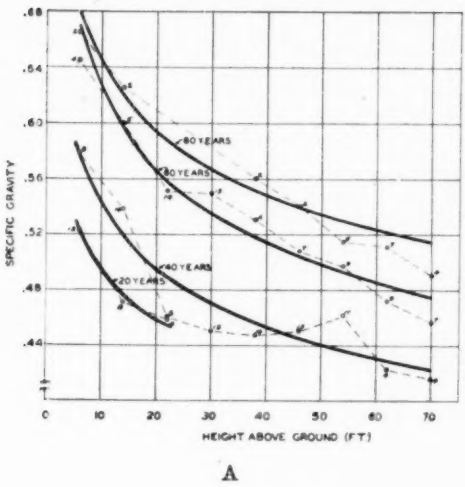

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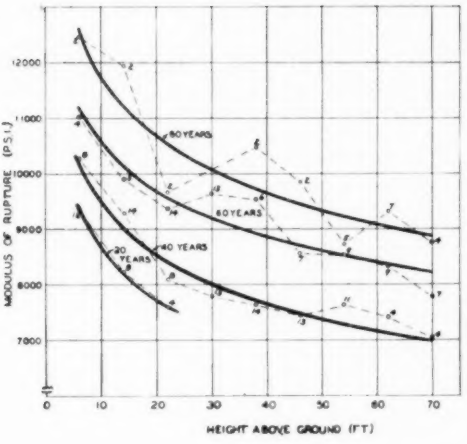
TABLE 3.—COMPARISON OF PROPERTIES OF SECOND-GROWTH DOUGLAS FIR WITH ESTABLISHED VALUES FOR OLD-GROWTH COAST-TYPE DOUGLAS FIR (BASED UPON TESTS IN THE GREEN CONDITION)

	Specific gravity	Modulus of rupture	Modulus of elasticity
	Oven-dry volume basis	Lb./sq. in	Lb./sq. in
Second growth			
Site II tree[1]..	.523	9400	1,561,100
Site III tree[1].	.540	9191	1,538,300
Site IV tree[1].	.544	9246	1,711,800
Average	*.536*	*9280*	*1,603,700*
Curve value[2]..	.524	9140	1,633,000
Old growth[3]	.51	7600	1,550,000

[1]Based for purposes of comparison only upon test specimens obtained from the second bolt of each tree, the section occurring 8-16 feet above the stump.

[2]Read from the curves for combined Zones 1 and 2 (Fig. 1) at 14 ft. above ground.

[3]U. S. Dept. Agric. Tech. Bul. 479, Table 1. Based upon results of tests of 30 trees supplemented by data from an unknown number of additional trees.



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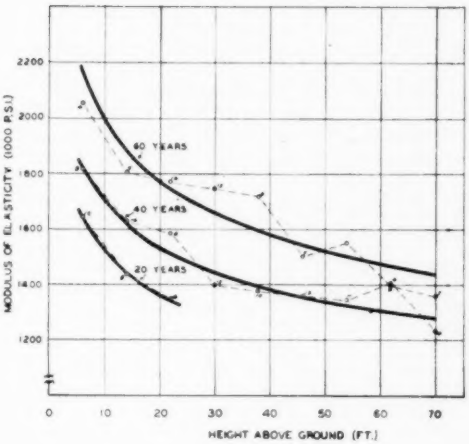

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FIG. 2.—Effect of age of tree and height above ground on the properties of second-growth Douglas fir: (a) specific gravity, (b) modulus of rupture, (c) modulus of elasticity.

erties of each tree individually by age-classes and height above ground, general trends similar to the combined family of curves were shown.

For some age-classes the logarithmic curve is probably the best fit that could be obtained. For other age-classes, perhaps other type curves would give a better fit to the basic data. However, due to the character of these data, it was felt advisable not to deviate from one type of curve and logarithmic curves were arbitrarily adhered to throughout. It appears that all three properties increase with increasing age up to 80 years, the maximum age tested, and this is apparent at all heights above the ground up to the limit of 70 feet. At 20 years, specific gravity dropped from .52 at 6 feet to .45 at 22 feet, whereas at 80 years specific gravity declined from 0.68 at 6 feet to 0.51 at 70 feet. Similar trends are shown by the data for modulus of rupture and modulus of elasticity. The trend at greater heights above ground may be considerably altered, which in turn would influence the slope of the portion of the curves shown. Extrapolation of these curves without additional data would be very hazardous. A curve for modulus of elasticity in the 80-year age class has been omitted from Figure 2, c, since the basic data showed no well defined relationship.

Conclusions

From the results of a study of the bending strength properties of three second-growth Douglas-fir trees, the following qualitative conclusions may be permitted. Specific gravity, modulus of rupture, and modulus of elasticity tend to increase outward from the pith. The same three properties tend to decrease, rapidly at first, then more gradually at increasing heights above the ground. It appears, although it cannot be shown statistically from the data presented, that these three properties tend to increase with increasing age at all heights up to the limit of 70 feet. For all age-classes, these properties decrease with increasing height above the ground, rapidly at first, then assuming a more gradual rate of decrease. The number of trees studied was not sufficient to permit a conclusion as to whether or not strength properties vary with site quality.

TABLE 4.—STATIC BENDING PROPERTIES OF SECOND-GROWTH DOUGLAS FIR BY AGE CLASS AND HEIGHT ABOVE GROUND (FT.)

Age class yrs.	Property	Height above ground (Ft.) 6	14	22	30	38	46	54	62	70
11-30 (20)	Specific gravity	.522	.471	.458						
	Modulus of rupture, p.s.i.	9363	8221	7580						
	Modulus of elasticity, 1000 p.s.i.	1643	1434	1346						
	Number of tests	12	8	4						
31-50 (40)	Specific gravity	.578	.538	.460	.450	.447	.450	.461	.422	.415
	Modulus of rupture, p.s.i.	10273	9283	8093	7775	7635	7441	7617	7396	7034
	Modulus of elasticity, 1000 p.s.i.	1816	1628	1587	1398	1377	1359	1344	1406	1237
	Number of tests	8	14	8	13	14	13	11	4	4
51-70 (60)	Specific gravity	.645	.600	.551	.549	.530	.508	.497	.472	.456
	Modulus of rupture, p.s.i.	11022	9897	9364	9694	9531	8546	8515	8325	7767
	Modulus of elasticity, 1000 p.s.i.	2058	1804	1770	1745	1716	1500	1550	1397	1360
	Number of tests	4	5	14	13	6	7	9	9	7
71-90 (80)	Specific gravity	.665	.625	.515		.560	.540	.514	.511	.490
	Modulus of rupture, p.s.i.	12465	11920	9655		10472	9840	8714	9314	8750
	Modulus of elasticity, 1000 p.s.i.	1590	1555	1602		1868	1860	1532	1582	1555
	Number of tests	2	2	2		2	2	5	7	4

A Methods Study of the Cumulative Volume Tally Sheet[1]

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Purdue University, Lafayette, Indiana.

Foresters will want to read this novel study of the cumulative volume tally sheet not only for the practical suggestions to improve the form, but also because the analysis and results are typical of numerous improvements which could be made in similar activities.

RECENTLY, while doing some work on form simplification at the Purdue Motion and Time Study Laboratory, the writer turned his attention to the cumulative volume tally sheet[2] which has found such favor with foresters as a practical cruising aid (See Fig. 1). As with most types of forms, the users take the layout for granted. The possibilities and advantages of different form arrangements are given little thought.

But before taking any form arrangement as a matter of course, it is well first to see if improvements are needed. In this case there are two vital questions:

1. Are the results of tallying and computing satisfactory?

2. Is the form convenient and economical to prepare?

Let us look at the answers to these questions.

Question 1. Tally sheets of the type shown in Figure 1 have been used by the students at the Purdue Forestry Summer Camp for the past two summers. From watching the tally sheet in use, it is estimated that about ten percent of the forms had errors in tallying. A check of 1,120 completed forms showed that approximately seven percent had an error in computing. These errors resulted from overlooking values, reading values incorrectly, etc. These observations show that the results of tallying and computing are not entirely satisfactory.

Question 2. The tally sheet cannot be conveniently prepared by individuals to meet specific needs. This is true particularly when only a limited number of forms is needed for small jobs where different standards of utilization are used. If printed forms are not available, under such circumstances many foresters would use the ordinary tally form.

The Study

The above answers indicate, first, the need for a new form layout that will reduce errors in tallying and computing, and, second, the need for a form or technique that will enable one to realize the results obtained with the cumulative volume tally sheet without using a number of printed forms.

The writer's first step toward these ends was to make a 16-mm. motion picture of an artificial laboratory set-up of the tallying operation. This work was done under ideal conditions in the Purdue Motion and Time Study Laboratory. A series of 20 values giving the dimensions of trees by d.b.h. and merchantable height in logs (18-2, 24-3, etc.) were selected at random and read to a recorder at an arbitrarily selected rate of 25 values per minute. The recorder, using the form shown in Figure 1, tallied these values and computed the volume and number of trees by d.b.h. classes while the motion picture was taken. Modified micromotion study[3] techniques were used to analyze this film. By this procedure it was possible to study the tallying operation to a degree of refinement impossible by any other means.

The analysis showed that during tallying as well as computing there is considerable searching for the correct values. It was assumed that this searching was in a large measure the cause of the errors. Considerable thought was given to finding a form layout which would correct this.

Of the forms studied, the two which aid most in the speedy and accurate location of values are shown in Figures 2 and 3. In comparing these new form arrangements with the original arrangement the assumption was made that if the proper value could be located more rapidly on a form there would be less chance of making errors in tallying and computing. With this assumption as a basis the actual comparison of the new forms with the original form was made as follows:

1. For the original arrangement and the two

[1]Journal Paper No. 337 of the Purdue University Agricultural Experiment Station, Lafayette, Ind.

[2]Macon, J. W. and S. R. Gevorkiantz. Estimating volume on the spot. Jour. Forestry 40:652. 1942.

[3]Micromotion study is the study of the fundamental elements or subdivisions of an operation by means of a motion picture camera and timing device.

new arrangements, forms covering the same range of tree dimensions were prepared (ten to 40 inches by two-inch d.b.h. classes).

2. By preliminary tests with five selected students the maximum rate of tallying on the original form was determined for men with a high aptitude for this type of work. The maximum rate was determined to be 40 values per minute.

3. Series of values selected at random were read at the rate of 40 per minute to students divided into three groups, each group being assigned one of the three forms. The students tallied as rapidly as possible in the conventional manner. When tallying was completed, each man determined the number of values missed (i.e., values that could not be recorded because of lack of time) and the number of values tallied incorrectly.

Two separate tests, using this procedure, were conducted. The results were as follows:

Test 1. Basis: 27 students divided into three groups of nine each; 20 values read.

	Form shown in		
	Fig. 1	Fig. 2	Fig. 3
Average number of values missed	3.44	1.33	1.33
Average number of values tallied incorrectly	1.22	1.33	0.89

Test 2. Basis: 45 students divided into three groups of 15 each; 30 values read.

Average number of values missed	7.47	3.07	3.53
Average number of values tallied incorrectly	0.67	0.33	0.87

From this study it appears that the two new forms will allow more accurate tallying and computing. While there does not appear to be a significant difference between the new forms, it was decided to accept the horizontal arrangement (Fig. 2) because it is easier to handle in the tatum holder as normally used.

This horizontal arrangement is applicable regardless of the range of d.b.h. and height classes, but the fewer the values on the form the less confusing it will be and the easier the preparation of the form. Consequently, when it is practical, one should determine the range of tree dimensions required for the specific job on which the form will be used. It should be realized that if only occasional large trees will be encountered it is unnecessary to include these

FIG. 1.—Portion of original type cumulative volume tally sheet prepared for use with one-fifth acre plots in Indiana hardwoods. The conventional method of recording trees and of obtaining volume per acre is illustrated. Trees of different species may be recorded by using different symbols in crossing out the numbers.

		VOLUME IN HUNDREDS OF BD.FT.— DOYLE—BY DBH AND NO. OF 12-FOOT LOGS															TOTALS
10	1	Ø	✗	✗	2	2	2	3	3	4	4	4	5	5	6	6	6
	2	✗	✗	2	3	3	4	5	5	6	6	7	8	8	9	10	
12	1	✗	2	3	5	6	7	8	9	10	12	13	14	15	16	17	11
	2	2	4	6	8	10	11	13	15	17	19	21	23	25	27	28	
	3	2	5	8	10	12	15	18	20	22	25	28	30	32	35	38	
14	1	2	4	6	8	10	13	15	17	19	21	23	25	27	29	32	25
	2	4	7	11	14	18	22	25	29	32	36	40	43	47	50	54	
	3	5	10	14	19	24	28	33	38	43	48	52	57	62	66	71	
	4	6	11	17	22	28	34	39	45	50	56	62	67	73	78	84	

4.2 M per acre

FIG. 2.—Cumulative volume tally sheet of horizontal arrangement prepared from the tally sheet in Figure 1. The method of recording trees and of obtaining volume per acre is shown for the same trees used in Figure 1.

large sizes on the form. For example, it was determined from an analysis of cruise sheets used on the Clark State Forest (Henryville, Ind.) that tally sheets with a range of from ten to 30 inches in d.b.h. and a maximum merchantable height of three logs, would include all but a few large trees. The dimensions of the few trees that cannot be tallied on the tally sheet can be recorded on the bottom of the page and the volume immediately determined by reference to an appropriate volume table. This volume can be quickly converted to volume per acre before being recorded. If careful consideration is given to the range of tree sizes to use, one should have less than one percent of the plots that have trees that cannot be tallied on the form. Looking up the volume of an occasional large tree constitutes little if any delay for most foresters because they usually give special attention to the large trees no matter what the method of tallying.

In addition to limiting the range, the number of values included for any d.b.h.-height class should be kept at a minimum. If one intends to use one tally sheet per plot, the number of values included in any such class should be no more than the maximum number of trees of that class that can be found on any plot in the forest. If it is desired to tally more than one plot per sheet, it will be necessary to increase the number of values accordingly. A general knowledge of the forest in which cruising is to be done will enable the forester satisfactorily to solve this problem.

We now have a reasonable solution to the

VOLUME IN HUNDREDS OF BD. FT. — DOYLE — BY DBH AND NO. OF 12-FT LOGS								
10		12			14			
1	2	1	2	3	1	2	3	4
Ø	✗	✗	2	2	2	4	5	6
✗	✗	2	4	5	4	7	10	11
✗	2	3	6	8	6	11	14	17
2	3	5	8	10	8	14	19	22
2	3	6	10	12	10	18	24	28
2	4	7	11	15	13	22	28	34
3	5	8	13	18	15	25	33	39
3	5	9	15	20	17	29	38	45
4	6	10	17	22	19	32	43	50
4	6	12	19	25	21	36	48	56
4	7	13	21	28	23	40	52	62
5	8	14	23	30	25	43	57	67
5	8	15	25	32	27	47	62	73
6	9	16	27	35	29	50	66	78
6	10	17	28	38	32	54	71	84
6		11			25			

4.2 M per acre

FIG. 3.—Cumulative volume tally sheet of vertical arrangement prepared from the tally sheet in Figure 1. The method of recording trees and of obtaining volume per acre is shown for the same trees used in Figure 1.

problem presented by Question 1. Let us next turn our attention to Question 2.

In this case it appears that the solution lies in eliminating the need for a quantity of printed forms. The cumulative volume tally sheet is what we may call a *computing form.* This type of form, while not common, is used occasionally by engineers. Where used it is the practice to have one master form that gives the values, and to do the actual computing on a second sheet or transparent sheet placed over the master form. Taking this lead, the following procedure to enable tallying with only one prepared form was developed:

1. With a black pencil or typewriter, prepare a clear cumulative volume tally sheet to serve as a master form. Use the arrangement shown in Figure 2, and keep the range and number of values in any d.b.h.-height class at a minimum.

2. Take a supply of transparent sheets[4] equal to the number of tally sheets required for the job at hand. Place three staples at the top of these sheets and fasten them in a tatum holder.

3. Place the master form under the first transparent sheet. Record the plot information (line number, plot number, etc.) at the top of the transparent sheet, and tally and compute in the conventional manner, using the master form as a guide.

4. After a plot has been finished, clip the completed transparent sheet to the tatum cover, and place the master form under the next transparent sheet so when the next plot is reached tallying may start at once.

[4]Falcon Transparent Manifold is recommended.

If volume computations are completed in the field, as they should be, the completed transparency makes as permanent a record as the conventional cumulative volume tally sheet. For convenience in referring the volume values to the correct d.b.h. class, a grouping of completed transparencies may be placed slightly offset over a master form so the diameter values are showing, or the d.b.h. value may be recorded in the field when tallying the first value for any diameter class. By using simple techniques of this nature, one can handle a group of transparencies as conveniently as a group of conventional cumulative volume tally sheets.

Summary

By a methods study of the cumulative volume tally sheet an improved form was developed (Fig. 2). This form can be used exactly as the original type form, but it allows more accurate and convenient tallying and computing. In order to eliminate the need for a quantity of printed forms, tallying may be done on a transparent sheet placed over a master form. This simple technique makes it possible for a forester to arm himself quickly with a series of cumulative volume tally sheets for different standards of utilization using nothing more than a ruler, a black pencil, and the appropriate volume table.

This new form and simple tallying technique have been tried by several practicing foresters who have used the cumulative volume tally sheet since its inception. They were all in agreement that the new form and tallying technique made their work easier and more accurate.

Forestry in a Great Metropolitan Area

James H. Tyndall
Associate forester, Forest Preserve District of Cook County, Ill. Member, S.A.F.

The administrative organization of The Cook County Forest Preserve District, consists of a general superintendent, aided by personnel from the departments of engineering, maintenance, conservation, and forestry. This article is intended to shed some additional light on what constitutes recreational forestry, and the responsibilities of a recreational forester in a metropolitan forest recreation area.

"THEY can't see the woods for the trees," truly describes the 15,000,000 people who recreate annually in the Cook County Forest Preserve District. This 37,000 acre tract, with 17,000 forested acres provides "northwoods atmosphere" for 4,500,000 people from the city of Chicago and suburban communities. Some part of the 65 mile long preserve, generally following the major water courses from the north to the south of the county, can be reached by any of these people by a 30 minute drive. Many areas are directly accessible by street car or bus. Yet, most of these people who visit the preserves 3 or 4 times a year think of it as a little patch of woods which God supplied and regardless of how they use it or abuse it, their favorite picnic spot with its stately oaks and maples, its adjacent wild flower beds, and grassy meadows, will always be ready and waiting for them—when they get the urge to use it again. Few realize that the maintenance of these areas require the services of technical foresters, trained in recreational forest management. In fact, very few of them would know to what family of arts and sciences the forester belongs, so little is his profession publicized.

Nevertheless, any person remotely acquainted with ecology, should appreciate the potential problems involved when an 80 acre tract, for example, is visited by 50,000 people Sunday upon Sunday, or where nationalistic, religious, industrial, or political picnics of 500, 1,000, and even 20,000 are common.

What is recreational forestry? We hear the term used freely by foresters and educators, but there is no short technically worded definition. To those of us engaged in the work it's engineering, it's landscaping, it's agriculture, it's aboriculture, it's forestry, and above all, it's protective *maintenance*.

The Forest Preserve District with its lakes, streams, woods, meadows, trails, picnic areas, golf courses, swimming pools, and people, has a function somewhere between the city parks and the wilderness areas of the U. S. Forest Service. It is an area designated to enable the underprivileged people, and others unable to enjoy a northwoods vacation, an opportunity to get close to nature—to get roots in the land.

In such an area forestry is practiced—not to produce timber for pulpwood, veneer, or lumber—but to protect what is present and—if you please—to insure a sustained yield of recreational forest area.

The kind of forestry, or better, the amount of forestry practiced must be tempered to meet the requirements of three distinctly different types of use areas—areas of intensive use, areas of light use, and wild areas. No attempt will be made in this article to discuss each of these separately. A clearer picture can be presented by less formality.

Development of Management Policy

Back in 1903, with appointment of the first Board of Forest Preserve Commissioners, then known as the Outer Belt Park Commission, the main premise of the commission was stated as follows: "What is needed to supplement the Chicago Intramural Park system is the outer parks of forest and meadow land unimproved. These lands left in their native state. They should receive no artificial park treatment. Residents of our crowded districts can enjoy the pleasure of camp life there. They can have boating; they can fish; they can bathe and swim; they can eat and pick the nuts and wild fruits; they can gather the flowers of the fields and forests; they can see and hear the birds and other forms of wild life; they can be close to the heart of Nature; they can find rest from their toil and refreshment for work to come."

Time changed much of this. This statement was made when there were practically no automobiles, but few roads, when the country areas

were rather inaccessible and the population of Cook County was 1,800,000. The administrators were anxious that the public use the preserves and realize the value of the holdings. As a result many commitments were made which later proved embarrassing. Areas were set aside for special groups; houses and camp sites turned over to Boy Scouts groups, and similar organizations; neighbors were permitted to graze their livestock to the detriment of the forest; people were permitted to erect tents which later became semi-permanent, and automobiles could be driven "helter skelter" throughout the forest.

Time, plus the improvements in transportation and an increased population, made it evident that many of these policies, founded in all sincerity, were detrimental to the management of the forest. A reorganization plan adopted in 1929 marked the beginning of a developmental phase which is still current. This plan stated in part: "To adopt a general plan of reforestation using all possible and available varieties of native trees. To study each tract by itself and to assist the organization of the forest preserve district in the development of each individual tract, the plans to include forested and open areas, layout of drives, walks, parking spaces, public comfort stations, picnic grounds, playgrounds, swimming pools, golf courses, refectories, concessions etc., and to set up the necessary administrative machinery to make the plan work."

Construction Program

In many instances this was a complete reversal of the original policies. It meant the beginning of a huge construction program and more complex maintenance problems. Most important, from the forestry standpoint, it meant the creation of a forestry department with technical personnel to administer the forestry program.

The construction program marked the beginning of control of the automobile. The automobile was definitely a destructive agent within a natural landscape. It penetrated the interiors, and left ugly scars. It knocked down and broke off shrub and tree seedlings. It barked the trunks and main roots of the older trees. It packed the earth causing trees to starve for lack of food and air. In wet weather it left ruts that eroded or deepened with each succeeding rain. These scars had to be mended. With CCC labor available during the depression era, most of these eroded areas were leveled and planted. Black locust proved to be the best species to use in this planting. Men under the supervision of a competent tree surgeon repaired the damage done to the larger specimen trees in intensive-use areas, and broken and damaged trees and shrubs were removed.

Fundamentally the construction program consisted of developing a sufficient number of small areas strategically located for intensive use while protecting the large remainder against encroachment, excessive use, and destruction by fire, insects, and disease. Even though our picnic areas provide the simplest of facilities, every time a parking space is made, a well is dug, a foundation is laid or a walk is built; soil is compacted, trees and shrubs are damaged or destroyed, and grass areas laid bare. Here was a job for the forester. In some instances, a landscape plan made by the landscape architect is followed in replanting. In other instances, especially where the type of construction permits, a simple planting to emulate nature, without the aid of a plan on paper, is the rule. Barren areas are seeded or sodded with native grasses and damaged trees are repaired.

Entrance roads into picnic areas require drainage ditches. In many instances the construction of these ditches has lessened the moisture normally available for tree and shrub growth. In some areas this has had the effect of changing the reproduction from a desirable to an undesirable species. We also attribute some stag-headedness in oaks to this upsetting of the water table. Very little can be done to avoid such damage, but the affected areas can be kept small. Also it is the policy to locate entrance roads so that a minimum of change in drainage will occur.

All roadways and parking areas require some type of barrier. Originally most of our barriers were of wooden post and rail, cement post and cable, or a V-ditch type. The maintenance cost of some of these types of barriers has lead to their replacement by planted barriers. Experience has proven that only the most sturdy and tolerant species—tolerant especially of man—will survive in such a planting. Hawthorne, wild plum and wild crabapple, weed trees in most of our areas, serve us well for this purpose. Other species used to obtain height and naturalness are white and green ash, American elm, silver maple, coral berry, black currant, and wild grape. Already some of these planted barriers are giving us maintenance problems. When

the species are planted close enough to a parking area boundary to effect automobile control we find trimming necessary in a few years. If the planting is confined to eliminate this future maintenance the parking areas soon assume weird unplanned shapes. To strike a happy medium here, a heavy planting of the tree species is made next to the roadways and parking spaces. In a few years these trees will act as a barrier, and the lower limbs may be pruned off without ruining the naturalistic effect. Ditch barriers have served well against meadows and open areas, but the presence of large trees adjacent to the roadways and parking areas often make this construction impossible.

A recreational area without trails would certainly not be complete. Most of the 150 miles of trails in the forest preserve district, meander through the timbered areas. These trails are simple, unimproved, cross country trails which must serve the hiker, the bicyclist, the equestrian, and our service trucks. Of their type, they represent the finest trail system in America, but our "customers" forget they are in a forest preserve, and would have us maintain them as they might be found in a city park. Specifically the horseback riders and bicyclists very much resent any obstruction that will prevent them from riding four abreast.

The additional sunlight that the opened up trail area allows, along with the elimination of root competition causes increased growth on all vegetation adjacent to the trail. With our fertile soil, the thorn trees—wild crabapple, plum, and hawthorn—and such species as the choke cherry, willow, linden, ash, and elm grow so rapidly as to necessitate annual pruning. In many cases pruning back to eliminate overhanging and projecting hazardous limbs and branches has only tended to aggravate the situation due to increased sprouting. Hence a continuous pruning problem is inevitable. At present we try to prune in such a manner that additional work will not be needed for at least three years. This seems to satisfy the public and along with our other work allows us to complete the circuit.

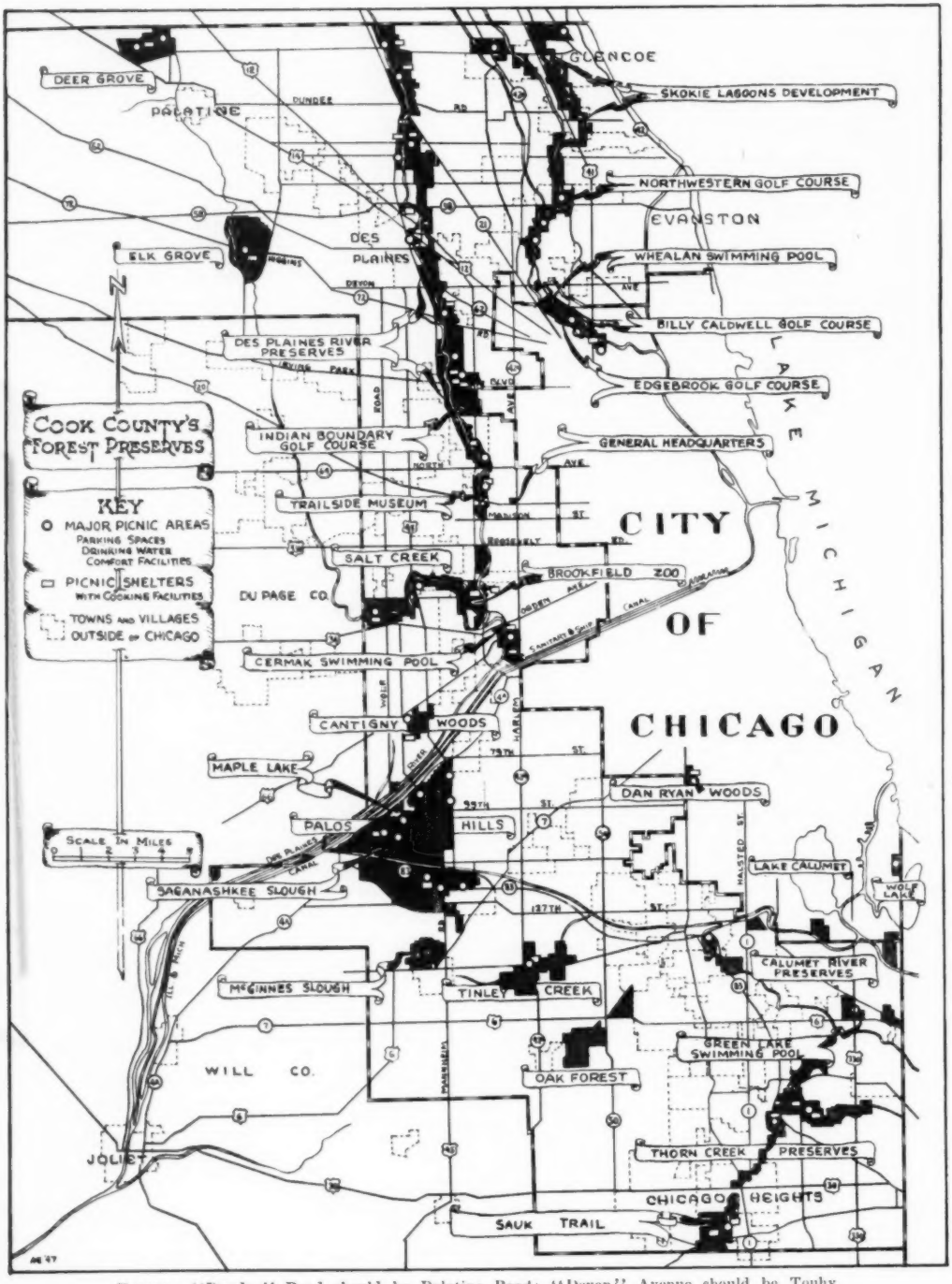
Tree Care

Recreational forestry involves arboriculture. We do as little of this individual tree preservation work as possible, and yet as much as is necessary. Of the thousands of picknickers who make use of the forest preserves few venture beyond the picnic centers into the interiors. This concentration of use is the principal reason why so many of the large trees in these areas are rapidly going "down hill," even though far from being over-mature. In such areas soil compaction is almost universal. The woodland humus or duff is completely lacking and in most cases water run-off is very rapid. Misuse is extensive. Limbs are broken off; trunks are "hacked" with every conceivable kind of knife edged instrument; fires are started at the base and in hollow trees, and live trees and shrubs are cut down to be used for spits, fishing poles, horse-shoe pegs, shinny clubs, and firewood. Grass—there seldom is any grass left. It is therefore inevitable that branches in trees and shrubs will die. These dead branches become a hazard to visitors as well as a detriment to the appearance and health of the tree. When time and labor is available a sanitation pruning is made in these areas. In many of the groves we are losing two or three of our key trees each year. Those dead trees that are apt to be hazardous and are located in picnic areas, and along the trails and major highways are removed. All others are left standing for the wildlife value they possess. Some of the more solid logs are salvaged but in most instances the limbs are lopped and scattered and the logs left in the woods.

Some key specimen trees in our more heavily used picnic areas, and around administrative headquarters buildings have been fertilized using a complete inorganic fertilizer. The fertilizer not only gives the tree a much needed "shot in the arm" but the methods used have also tended to areate the soil and lessen the amount of rapid run-off—until intensive use again makes the soil practically impervious.

Occasionally one of these key trees having the tight V-shaped crotch will show signs of splitting. In such cases cabling and bracing is done. As a general rule, however, labor is not available for such work.

One might guess that insect damage would be a problem here due to our proximity to vast landscape plantings. Actually, damage is slight. Periodically such insects as the walnut datana, fall webb worm and cankerworm do some damage in the forests. In no instance have the occurrence of these insects been in epidemic form. Scale insects, especially in new plantations and in our barrier plantings have been sufficiently destructive to warrant a spraying program for their control. In 1939 the periodical



ERRATA: "Dundee" Road should be Palatine Road; "Devon" Avenue should be Touhy Avenue; "McGinnes Slough" should be McGinnis Slough.

Cicada paid the preserves a short visit and left their calling card in the form of hundreds of damaged trees.

Mortality in the oak stands in some of our wild areas has been very high. The loss has been greatest where trees were growing on heavy clay soils, and especially on heavy clay slopes where water absorption was rather limited. Unless these trees are conspicuous from the highways they are not removed. Some of these areas have become very popular with the mushroom loving Bohemian people, because nearly every dead tree becomes infested with shoe string root rot, *Armillaria mellea*. The mushrooms of this fungus are among the finest edible mushrooms found in this area. To date, disease has never been a really serious problem in any of the preserves.

Reforestation

The control plans for the forest preserve district call for 10,000 acres to be planted. Most of the forested areas were once farm lands, heavily grazed, hence little reproduction was present when these lands were purchased. With the elimination of grazing, and where a dense layer of sod has not developed, natural reproduction has taken place. Exceptionally good natural reproduction has been obtained in the lowland hardwood types, and in the sugar maple-oak-hickory stands. Many of the white oak-red oak stands, which predominate, are very much lacking in reproduction. In these areas an attempt is being made this year to get reproduction through a scarification process, using a small tractor pulling a double disc. This method is in the experimental stage, but we hope that with the cutting up of the heavy sod the acorns will have a better opportunity of getting in contact with the soil.

The open meadows also contain a heavy layer of sod. In these areas only the wild crabapple, hawthorns and wild plum have been able to reproduce, and these species are not well suited for recreational development. Such areas must be planted. Native hardwoods propagated and grown in our own 40-acre nursery are used.

Very little maintenance work is needed in the plantations. In some plantings it has been necessary to do some pruning to eliminate a shrub type growth. In most instances this type growth has been caused by fire, rodents or dieback and subsequent coppice development. When plantations have reached a height of 6 to 10 feet we have found that a judicious pruning of the lower limbs will cause a noticeable increase in height growth which is desirable.

Meadows

To maintain an area in its natural state requires meadow areas as well as forests. While some open areas are planted, others are designated as permanent meadows. These areas constituting attractive vistas in a forested landscape, in addition to their scenic and recreational values, contain many forms of wildlife. Many of the areas are surrounded by dense shrubbery and the weedy tree species—haws, plum, and crabs. Wild game find protection and food in the thickets, and nesting grounds in the meadows. The presence of wild game in these surroundings has resulted in considerable reproduction of wild plum, wild crabapple, and hawthorns in the meadows. This presents a problem in eradication of these weed species. By annual mowing it has been possible to keep most of the meadows free of these trees. Where they have reached a size too large for mowing, 2,4-D has been used. The use of 2,4-D on haws and crabs has produced some unusual results. Some trees were completely killed. Others may have all but two or three branches killed, while still others show complete die-back of top and trunk with subsequent sprouting. The choke cherry and dwarf willow have been rather easily killed with 2,4-D. In a few instances where the tops of choke cherry trees were not hit by the spray, the portion not hit came out in full leaf the following year while the sprayed portion had no leaves and the branches were dead and brittle. Additional experiments are being carried out on this type vegetation to determine the most effective method of control.

Weeds—especially the Canada thistle, and their eradication has become an annual forestry project. Like the haws and crabs these pests will, and do, grow everywhere. Complaints by taxpayers and especially from owners of golf courses adjacent to the forest preserves have justified an intensive thistle control program. To add to the weed control problem, poison ivy seems to reproduce best in the picnic areas. Naturally "this gets under the people's skin," and again 2,4-D comes in very convenient for control. Ammonium sulfamate has also been used successfully in eradication of poison ivy, especially in shady areas where 2,4-D is not too effective. Each year a rank growth of weeds and grass develops along the edges of parking spaces, driveways and guard rails; areas which

are inaccessible to the powered mowers. Nonselective herbicides have been used with varying results to eliminate such vegetation. Although complete season-long kill is not achieved the results have been fairly satisfactory.

Fire Control

In early spring and late fall fires in woodland, meadow and peat areas are a constant menace. Today there is no lack of accessibility. With 200 miles of highway frontage, and an even greater length of frontage backed up against private property, the trails, rivers, lakes and picnic areas, accommodating 15,000,000 people a year, the fire potential is naturally constant. Prevention work is carried on by means of controlled picnic fires, and personal contact with adjacent landowners, printed posters and 90 miles of plowed fire lanes.

Fire suppression is accomplished by a forest preserve fire fighting organization which is aided by ranger patrol, by reports from neighboring observers, by caretakers, and by voluntary aid from nearby village fire departments.

Control of Use

The capacity of any one picnic area to support human use without serious permanent deterioration is determined by the nature of the soil, topography, moisture condition and type of vegetation present. To aid in calculating this capacity plus the need for a definite policy on silvicultural treatment, a 5 percent timber survey program is under way. As one might expect, those areas most accessible and best known have been used far above their determined capacity. A partial solution to this situation has been made. The Advisory Committee set forth the principle that no single living tree should be removed from any part of the forest preserves unless exceedingly careful study disclosed some urgent need for its destruction. Of necessity we have had to compromise this principle. By using natural openings and a judicious selective thinning we have provided additional picnicking area in these "over worked" groves. The next problem is to get the people to use these new areas. Unless the weeds and sprout growth is kept mowed, and tables placed in these areas the people still attempt to crowd into the old overworked groves. Hence, with the opening up of new areas we increase our maintenance load.

Always with the excessive use, we have abuse. One forest preserve official once said, "Probably 5 percent of the people are vandals who destroy either for profit or from wanton love of destruction; 40 percent are only heedlessly destructive, and can be circumvented or taught and some 45 percent are decent average citizens out for fun, but with a feeling that actually as taxpayers the woods are theirs to do with as they please." This human nature tendency is often a greater problem than nature itself. People are gregarious. Give a group five acres in which to play and they'll use one. Confine them to one and they'll "tear it up by the roots." Most of the damage has been to facilities, but as previously mentioned the vegetation also suffers. An intensive educational program expertly handled, through nature bulletins, lectures to school assemblies, radio, television and personal appearances by our conservation department personnel has reached thousands of residents of Cook County. One of the primary purposes of this program is to create an appreciation of nature, and a respect for public property, but no program, however intensive, can eliminate all vandalism. Frequently these rascals, usually teen-aged lads, will be apprehended and given a stiff sentence consisting of a few days weeding or planting in our nursery, or some other similar menial task to supplement our educational program.

Perhaps the most serious result of over-use from the forester's point of view is the compaction rendered the soil. Although this condition and its seriousness is not new, we are still working toward a satisfactory solution. The application of a 4-inch layer of well rotted leaf compost has been used to rehabilitate many of these bare, packed soils. There are many parkmen, however, who maintain little can be accomplished by this method. We only say, "We have found nothing better."

The maintenance of the turf on three 18-hole and one 9-hole golf course has recently been added to the duties of the forestry department, on the theory that we should manage everything that grows. Most private or public golf course managers would consider a player-load of 20,000 to 30,000 persons a year sufficient to create a critical maintenance problem. Consider the fact that our single 9-hole course has been traversed by as many as 90,000 players a year and you get some idea of the need for technical supervision. To supervise the turf culture has required the continuous service of one of our foresters. Many foresters "snicker" when told we are in effect caretakers of large lawn areas.

and fail to see any connection between this responsibility and forestry. I believe however, if we were to get our responsible forester together with a forester who is primarily interested in range management, we would find the two had many similar problems.

If you are still confused about the term "recreational forestry," add to the complex duties I have briefly covered, such chores as supervision of line clearing on and along forest preserve properties by utilities organizations; Boy Scout and Girl Scout planting programs; lectures to garden clubs, high schools, and civic organizations; pruning of overgrown trees and shrubs along sidewalks, highways, intersections, and entrance roads; preparation of flower shows; repairing the damages heaped upon us by wind, snow and sleet; and satisfying or side-stepping the special privileges, requests, and demands of 4,500,000 taxpayers—take an aspirin, get a good night's sleep—and dream up your own definition.

Army Reserve Commissions for Foresters

Reserve commissions in the Army of the United States are now available to qualified foresters who meet the requirements of age, education, experience, and physical condition. The commissions range from those of Second Lieutenant up to and including Major, depending upon the qualifications and experience the forester possesses in his specified field. Applicants must be at least twenty-one (21) years of age for appointment in the Reserve Corps, and must not have reached the forty-fifth (45th) birthday anniversary. All must be citizens of the United States. No previous military experience is required. These appointments will be made in the Corps of Engineers Reserve.

For appointment as Forestry Specialist, applicants must have had responsible supervisory experience in connection with the harvesting, manufacture, seasoning, preservation, and distribution of wood and its products, as follows: for First Lieutenant, seven years; for Captain, eleven years; and for Major, sixteen years. Qualifying experience includes supervisory activities in locating and establishing timber tracts; estimating quantity of usable timber in a tract; measuring and marking trees to be cut; felling and cutting trees and hauling logs; and establishing procedures pertaining to the milling of logs and the operation of saw mills.

A bachelor's degree in forestry may be substituted for four years of the qualifying experience specified above, and a master's degree may be substituted for five years.

Determination of the grade in which an applicant is to be commissioned is the function of the examining board interviewing the applicant, subject to final approval of The Adjutant General. The grade will be based on the total number of years of qualifying education and/or experience.

Full details of the program for commissioning of civilian foresters are provided in Department of the Army Circular No. 210, dated 14 July 1948. Application forms and Circular No. 210 may be obtained from local Reserve Unit Headquarters or from Organized Reserve Unit Instructors, or by writing to Army Headquarters at New York, Baltimore, Atlanta, Chicago, Houston, or San Francisco. Inquiries and requests for application forms and the circular may also be addressed to The Adjutant General, Department of the Army, Washington 25, D. C.

The Urban Environment of Foresters

A forester who does live in the woods effectively argues the case against wresting the forester from the trees with which he is concerned and from which he draws his inspiration.

Henry I. Baldwin
New Hampshire Forestry and Recreation Commission, Hillsboro, N. H. Member, S.A.F.

ARE AMERICAN foresters becoming urbanized? More and more foresters are moving into bigger and bigger cities, and becoming city slickers. Indeed they may perhaps never see a tree except some moribund park specimen. They and their calling are little more in place in the artificial environment of the city than is the tree. Just how many members of the profession have gradually become thus insulated and separated by miles of dingy suburbs and billboards from the original object of their interest is unknown, but there must be a very considerable number. They include many of the best minds and most capable men in the profession. That a reasonable amount of office work is absolutely necessary for progress in forestry cannot be denied and indoor records and maps are essential; nor is a partially sedentary habit of life without its merits. Forestry would have remained a mere art, and foresters, technicians or woodsmen, had not text books and journals been written by foresters who must perforce devote most of their energies to indoor work. But is it necessary that this office work be concentrated in highly congested metropolitan areas? A proper balance between field and office is essential.

Why Do Men Enter Forestry?

It is probable that most men were first attracted to forestry as a career because it appeared to hold the promise of life in the open, which nearly all men secretly desire. Witness the popularity of hunting and fishing, travel and other forms of outdoor recreation. How has it come about that this aspiration has faded, so subtly perhaps that the city-bound foresters are unaware of it? Some, at least, do realize it. A short time ago, a well-known forester who incidentally owns a small forest of his own, asked me what sort of experiment he could set up that would require him to get out in his woods every day—just to feel the forest and live with it. Forestry to the city worker becomes a mere abstract concept, a matter of paper work.

Trained for Field Work

First, a brief glance at forestry education, the customary place to blame most of all short-comings of foresters. Training in forestry schools appears to be aimed at turning out competent field foresters who can study forests at first hand and be capable of all sorts of silvicultural work and utilization. There is nothing to indicate that forestry schools fail to educate men for field work. The criticism from the standpoint of forestry education has rather been that graduate foresters have had too little opportunity to apply their skills.

Employers Select City Locations

Employers of foresters are most often responsible for where foresters live and work. Obviously many foresters, because of the nature of their positions must live at least within commuting distance of state capitals and college campuses. The U.S. Forest Service, the largest single employer of foresters, appears to have yielded to the urge for a general drift to the big cities that has been characteristic of all the population during the past few decades. Whatever the good reasons behind the policy, it is certainly apparent to the outsider that regional offices, supervisors headquarters, and even ranger stations have been moving to larger urban centers. Even forest experiment stations, in the early days located actually in the forest, have moved progressively to small college towns, to bigger and bigger cities, to darker and taller buildings. No doubt all these moves were thoroughly considered and made for reasons that appeared compelling. Recently, realizing this trend, efforts have been made to decentralize experiment stations by establishing branch research centers with headquarters in or near small towns. It is not intended to criticize these moves or the motives back of them, but only to point out the result on the personnel, on the communities and on the forest.

Effect of City Life on Foresters

Foresters, it has been observed, originally entered the profession because they liked the

woods. If not, they were misfits and took up some other work. A forester should not only be prepared to spend his life in the woods, but should welcome it. When, through necessity he becomes enslaved to a desk, he should at least be able to look out a window and see the forest, and in his off-duty hours enjoy its presence wherever he turns. His family should grow to love it as he does. It is natural that doctors and surgeons should be drawn to the great medical centers where their interest lies. So it is natural that foresters should be working and domiciled in the forest. Any other environment is unnatural. An organism out of its element acquires certain adaptations and foresters are no different than other people. They are affected by their environment in their interests, wants, thinking, and habits. A person working in a city becomes citified in outlook and preoccupied with many irrelevant matters. The Strong Interest Tests confirmed this, showing that the U.S. Forest Service personnel in higher grades had chiefly urban interests as would be natural. Salaries on which they could live well in the country are inadequate for a metropolitan society. Better schools, amusements, and cultural advantages, supposed to be rewards of city living, are often mirages. The men who should become leaders in small communities are submerged in large cities. All this results in the forester becoming changed. He commutes long distances to work, thus reducing both his effective working hours, efficiency, and free time. He must spend more time in travel when at rare intervals he does get out in "the field". The "field" all too often means visiting other offices in other cities. Even if he goes in the woods he rarely gets closer than three feet to the soil—the height of the automobile seat above the ground.

Effect of Rural Communities

Forestry is often extolled as an aid or even the entire support and salvation of rural communities. Many wood-using industries undoubtedly are, but without forestry they cannot become permanent. But it takes men to make communities too, and a forest ranger headquarters, experiment station, or other forestry activity not only is ecologically suited to a forest town, but its personnel can contribute much to community life through leadership in various local organizations. Such an office, no matter how small, gives some additional employment directly and indirectly. It brings in some additional business, in innumerable ways. Visitors to the office bring in more. Taxable property is increased. Even if the forestry activity is a public one, the employees, given a reasonable permanence and security of employment in one place, may become home-owners. If not, someone else builds and rents homes to them. In any case there is an added activity in town, an intellectual interest, something doing. That the importance of decentralized forest headquarters to small towns is not theoretical, witness the regret and actual complaints that have been voiced in some cases when a public forestry activity has been withdrawn from a small town and consolidated with some larger office. We deplore "sawmill ghost towns"; why cause "forestry ghost towns?"

Public Education at the Grass Roots

If forestry and foresters are to make headway in the education of the public and especially the private forest land owner, then foresters have got to get out in the woods and practice what they preach, rather than sit in some ivory tower in a far-off city. Nothing would promote more a better understanding of forestry than for practicing foresters to live and work in the small towns and on farms or in the woods where the people live who are going to have to solve problems of land use, forest depletion, and cutting practices. The writer recalls working with French-Canadian pulpwood cutters and convincing them that they did not need to swamp out all the valuable young spruce reproduction. It was a more satisfying job of forestry education than many other varieties of forestry uplift in which it has been his fate to indulge on more dressy occasions.

It often seems that too many foresters are riding around advising the other fellow what to do, but without opportunity to come to grips with actual problems of getting work done in the woods. The best way to acquire such experience is on one's own woodlot. It is recognized that a forester in the employ of another should avoid even the suspicion that his private business might engross too much of his attention to the detriment of his employer; nor should he engage in a business that competes with that of his employer. A forester living on a farm and managing his own woodlot can scarcely be accused of such competition. The first hand knowledge of the forest owner's problems thus acquired should make his services more valuable to an employer. What forester would not be in

a stronger position when addressing farmers and other land owners, if he could say: "I do it on my own woodlot and it pays."

Trained Foresters for the Forest, Not Office

Yes, foresters should spend more time in the woods. That is, if they are trained to be foresters. How long does it take to train a forester? Four to six and even more years of training at an academic level seem to be required. No one will contend that chief clerks and office managers or draftsmen need such lengthy preparation. When fully trained foresters are employed more or less continuously at tasks that can be performed by less technically trained personnel, there is waste, and inefficiency, and someone has blundered. Recently much concern was expressed editorially in a Swedish forestry journal over the tendency of foresters to spend too much time in the office. It was contended that the more highly trained a man was, the more of his working time he should spend out in the forest; that the cost to the government of educating foresters in the government school in Sweden was many times the cost of educating a good office manager, draftsman, or accountant. The forester should be the man in charge, but not have his usefulness and efficiency impaired by office detail. If forestry is to make progress in the woods, then let's put our best professional talent to work there!

Field Men Should Dictate Policy

If the forestry leaders are put to work in the woods, or conversely if the field men are given the responsibility of policy-making and major decisions, then this should have a salutory effect on the direction of forestry efforts. It is true, of course, today, that reports, advice, and proposals of subordinates in the field guide the executives and policy-makers in their decisions, and that many supervisors and regional foresters are much in the field, inspecting work in the woods. Then, why not have their headquarters in the forest near their work? In forest organization, the chief of each echelon should be primarily a field man actively supervising forest operations in the woods, and exercising general supervision over his office. The growing tendency today of foresters becoming office executives should be reversed.

Permanence of Abode and Work Essential

All men who work in the field know that one has to live with a certain piece of forest land many years, and with one's neighbors as well, to make substantial progress in forest management. One does not see much of his neighbors in a city. They are coming and going too. Foresters who move around the country, or who spend much time in long distance travel, lose touch with the forest and the soil. Furthermore, most men look forward to home life and a family as one of life's greatest satisfactions. Permanence of abode and home ownership are conducive to family life at its best. Also, few would deny that the country or small town is a better place for children than the large city. Yet, the policy pursued by many employers of foresters makes home-ownership practically impossible, continuity of work in a given forest area uncertain, and worst of all, city living and periodic moving an unpredictable but inevitable interruption in family and professional life. Such working and living conditions do not favor an active interest in the forest, or in becoming part of the community. If it is conceded that more forestry is needed in the woods, then that must be a compelling reason for foresters living where the woods are, and being given some assurance they will not be uprooted and shifted around the country. Employers of foresters should recognize the basic requirements for the care and feeding of foresters as well as trees. The two go together.

The Importance of Economic Considerations in Wood Waste Utilization Research[1]

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A generous amount of clear economic thinking by the chemist, engineer, or other specialist is necessary at the time waste-utilization studies are being planned and carried out. Such thinking should almost always include a consideration of the approximate quantity, character, and distribution of the waste that is suitable for the manufacture of given products, the probable cost of the waste at the plant, and the probable selling price of the products. Consideration of these items may eliminate certain studies and permit the concentration of effort on ones likely to develop processes that can be useful in plant operation and in wood-waste utilization.

MUCH work has been done on the economic aspects of wood-waste utilization. Operators of forest-product plants constantly try to reduce costs of raw material, and at the same time to increase net profits by its fullest economic use. In this paper, however, I wish to emphasize the importance of economic considerations in selecting, planning, and carrying out research projects in the field of wood-waste utilization.

Practically all forest industries produce a large volume of waste. This can be classified as logging waste and manufacturing waste. Logging waste includes: (1) trees left standing in the woods because of low quality or excessive cull; (2) parts of cut trees left in the woods for the same reasons; (3) trees badly damaged in logging and subsequent slash disposal. Manufacturing waste includes: (1) wood material not used in the primary manufacture of lumber, veneer, etc.; and (2) wood material not used in the secondary manufacture of furniture from lumber, plywood from veneer, etc. The effective use of waste is not only an individual plant problem but is also an industry-wide problem. To the extent that present supplies of lumber and other wood products are short, it is also one in which the public at large is interested.

Wood Waste Defined

But let's be more specific. Precisely what is included in the term "wood waste"? In practice a number of concepts are commonly used. The Society of American Foresters in its *Forestry Terminology* has defined logging waste and sawmilling waste. Logging waste is "that portion of the tree which has merchantable value, but is not utilized." Sawmilling waste is "that portion of the log having a merchantable value which is not utilized." The Society of American Foresters has defined "merchantable" as follows: "Used to designate the portion of trees or stands which can be profitably marketed under given economic conditions." These definitions are truly definitive only where merchantable value is expressed in terms of a given product, or a definite combination of products. The volume of unused material in a white oak tree 22 inches in diameter may be three times as great when cut into tight-stave bolts as it would be if cut into sawlogs. Actually, few persons in the hardwood regions of the United States would say that tight-stave cutting produced no waste because all material that economically could be put into tight staves was used. The given white oak tree should be converted into all products that can be made practicably and economically from it. Some operators and foresters have classified as waste only the unutilized material that could be processed economically into lumber. This concept may be valid, if no form of integrated logging or milling for products other than lumber is practicable.

Another concept of waste would include the unutilized material that cannot feasibly be used by such effectively integrated operations as the Crosset Lumber Company at Crosset, Arkansas, the Weyerhaeuser Timber Company at Cloquet, Minnesota, the Goodman Lumber Company at Goodman, Wisconsin, and others. Even this concept will not be static nor too precise. It will vary from one locality to another and within a locality from time to time, depending upon economic conditions and improvements in processing equipment. In the mountainous portions of the West, for example, far removed from the principal consuming centers of the country, timber is large and transportation costs are great. Under such conditions this concept of waste would be entirely different than it would be in the many parts of the East where close utilization of small timber is feasible. With the passing of time, however, the western concept is al-

[1]Presented at the national meeting of the Forest Products Research Society, Chicago, Ill., March 22, 1948.

most certain to change.

Still another concept of waste includes all material larger than a specified size regardless of the present feasibility of utilization. This concept more nearly conforms to Webster's definition of waste which is as follows: "That which has no original value or no value for the ordinary or main purpose of manufacture; parts or fragments of original stock not of a size suitable for use in making the product for which the stock was secured but which may be suitable for making another product, in which case the remaining parts or fragments are waste."

I have mentioned several concepts of waste. Others are possible, but they probably fall between the extremes given above. Certain concepts are useful for certain purposes. The last-mentioned concept is certainly the most useful in focusing attention on the supply of potentially usable wood material that undiscovered utilization techniques may possibly convert into useful products. It is approximately the concept on which most of the statistics presented in this paper are based.

Quantities of Waste Available

The economist in wood-waste utilization research frequently makes surveys to determine the quantity of waste material produced during a given period at a plant or in a specified locality. Such a survey was made on a nationwide basis in 1945 by the U. S. Forest Service, and the results published in Reappraisal Report 4, *Wood Waste in the United States*. In this report waste included the sound portions cut but not utilized from trees 5 inches and larger in diameter at breast height. The upper stems of conifers were included to a 4-inch top, and the limbs of hardwoods to the same minimum diameter. Furthermore, this volume included the sound portions of trees left uncut but badly damaged in logging operations and subsequent slash disposal. It included manufacturing waste such as the sound volume of slabs, edgings, trimmings, cuttings, shavings, sawdust, etc. The total volume of waste by these definitions was 6.5 billion cubic feet of which 2.5 billion cubic feet was used as fuel. The four billion cubic-foot remainder, which is immediately available for some use, does not include the volume made into such byproducts as lath, shingles, and dimension stock.

Only a small part of the four billion cubic feet of material not at present utilized can be processed into lumber economically. Furthermore, at present only a small part of it can be processed economically into low-quality items. The cost of processing it as fuelwood, for example, and transporting it to prospective consumers would be greater than the selling price which could be charged in competition with coal, oil, and other fuels. The fact that the quantity of waste by this definition is as great as it is, should not discredit any industry or group. It is a reservoir of raw material to challenge the ingenuity of utilization research personnel.

This reservoir of raw material should be studied with regard to its distribution and suitability for various uses. The results of this analysis should be helpful in showing what kinds of utilization research are needed to discover processes and equipment that can make possible the maximum use of wood now wasted. Such an analysis on a national scale should focus attention on our national wood-waste research problem and illustrate the type of analysis that can be made in the area tributary to any plant.

Figure 1 shows this four billion cubic feet of potentially useful material classified as logging waste and primary manufacturing waste. Nearly three-quarters of the total volume of waste is left in the woods in utilized parts of cut trees and in trees damaged by logging and slash disposal operations. Figure 3 shows the logging and manufacturing waste distributed by the geographic regions outlined in Figure 2. The quantity of waste is greatest in the Pacific Northwest and Southeast Regions. In the former, logging waste makes up a very large proportion of the total. In the latter, logging waste is still somewhat more than half of the total. Figure 4 shows the relative volume of the primary manufacturing waste that is in the form of slabs,

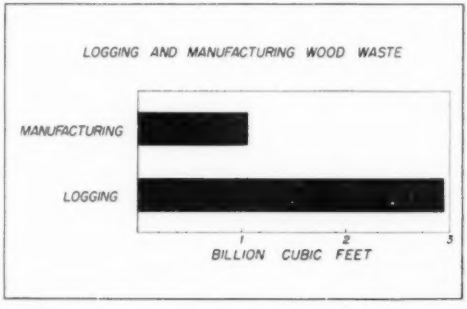

FIG. 1.—Logging and manufacturing wood waste.

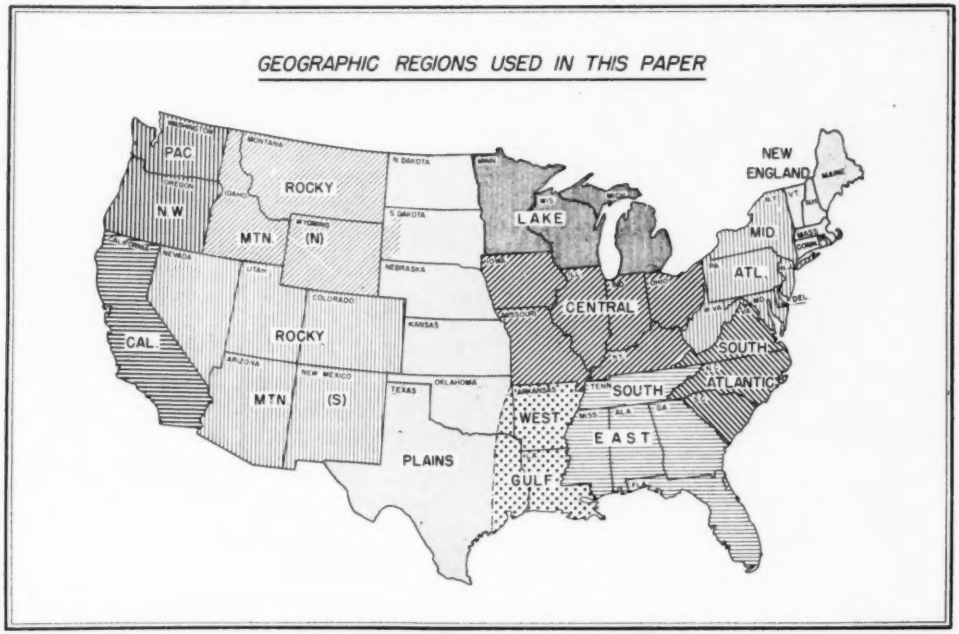

FIG. 2.—Geographic regions used in this paper.

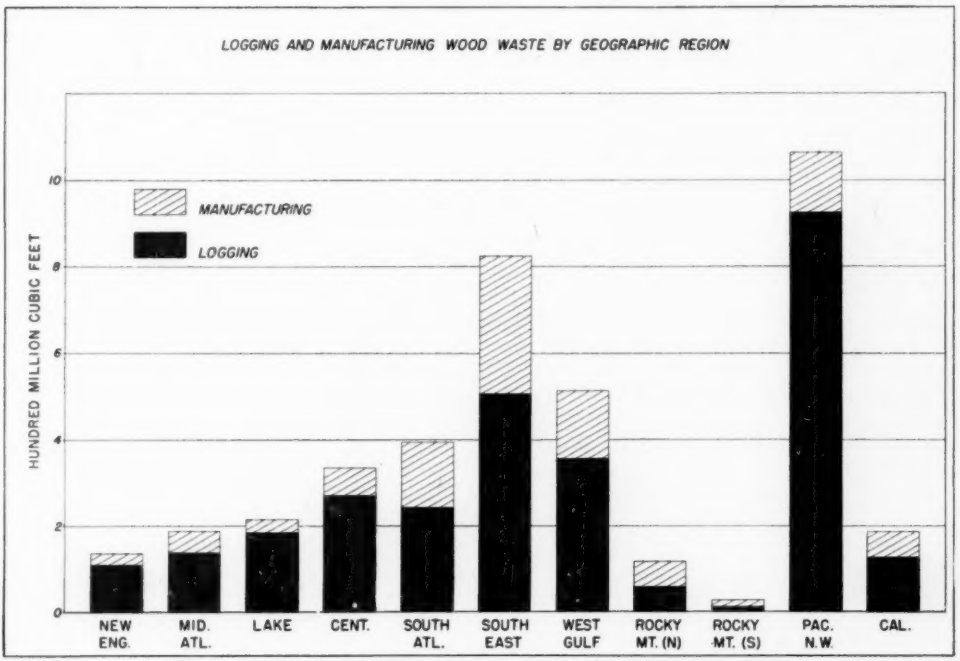

FIG. 3.—Logging and manufacturing wood waste by geographic region.

edgings, trimmings, and other coarse material and in the form of sawdust, shavings, and other fine material. The aggregate quantity of primary manufacturing waste is greatest in the Southeast Region.

Principal Economic Considerations

Careful examination of Figures 1 through 4 plus some knowledge of utilization practices and conditions common in various parts of the country permits five broad deductions.

1. Logging waste is the largest category of waste in absolute volume. Because it is also the most widely scattered, it is usually the least available economically. The principal exception to this generalization is in the Douglas-fir region of western Washington and Oregon. The concentration and transportation of this class of material normally requires relatively large expenditures of manpower. With current high wage rates, the cost of delivery at the consuming center is likely to preclude economic utilization of much of it until mechanization of woods work has proceeded much farther than it has at present. Accordingly, except where volumes of logging waste per acre are high, or where mechanized concentration and transportation are now feasible, more intensive utilization of woods waste will very likely have to await higher wood prices or further economies in production.

2. Primary manufacturing waste in relatively large quantities is available in the Southeast, South Atlantic, West Gulf, and Pacific Northwest Regions. In these regions, as else-

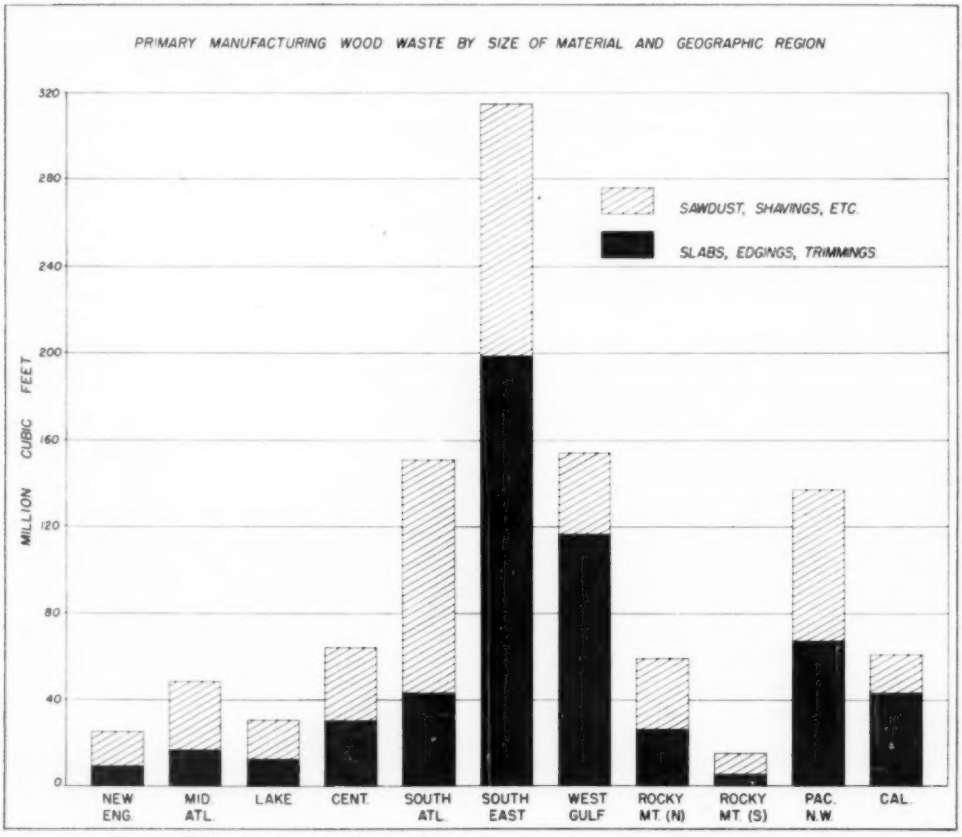

FIG. 4.—Primary manufacturing wood waste by size of material and geographic region.

where, this waste is partially concentrated at sawmills and other manufacturing plants. It is therefore theoretically more available than most logging waste. Actually much of it in the South Atlantic, Southeast, West Gulf, and other eastern regions is in the form of slabs and sawdust at innumerable, scattered, temporary settings of small portable sawmills. For most uses this material is not now practicably available, but must await the development of mechanized processes for picking up, transporting, and unloading it, or the development of a product that can be made from it that has a value sufficiently high to pay the present cost of collecting and transporting it to the consuming plant. Where large, relatively permanent sawmills or other primary manufacturing plants are common, as in nearly all parts of the West and at some locations in the Lake States and West Gulf Regions, a supply sufficient to attract potential waste users is available at or near given utilization points.

3. Wood now used as fuel can be diverted into other uses wherever the wood price exceeds the fairly low fuel value. In most regions more byproduct material of primary manufacturing plants is burned as fuel than is left unutilized. This diversion of wood use is often feasible where power is relatively cheap, as electric power is in parts of the West and South, and natural gas is in parts of the South. This use transfer could make available for higher use a large additional wood volume, which in some instances is relatively concentrated.

4. For the country as a whole, the volume of slabs, edgings, and other coarse waste material is greater than the volume of sawdust, shavings, and other fine material. In the Pacific Northwest Region a considerably larger volume of sawdust and shavings is used for fuel than is the case with slabs and edgings. In this region, therefore, the present and potential volume of fine waste material is larger than the corresponding volume of coarse material.

5. Lumber production statistics in the Pacific Northwest Region indicate that for 1945, about 68 percent of production was Douglas-fir, 17 percent ponderosa pine, 7 percent western hemlock, and the remainder western red cedar sitka spruce, white fir, and miscellaneous species. For practical purposes, this means that both the logging and milling waste for all products is distributed among the species in about the same proportions. Inclusion of pulpwood would certainly increase the proportion of hemlock somewhat. In this region, therefore, research on Douglas-fir logging and milling waste seems to offer the opportunity for maximum waste reduction. Considering lumber production of the total west, ponderosa pine accounts for 25 percent of all production. Since western mills are normally large enough to supply considerable quantities of concentrated waste, research on ponderosa pine mill waste seems to be justified. In Texas and Louisiana where larger mills still operate, lumber production is approximately 60 percent southern pine, 15 percent gum (red and tupelo), 15 percent oak, and the remainder miscellaneous species. Here research on pine mill waste seems to be in order, with gum and oak following in order of importance.

Local Features Affecting Waste Utilization

Problems of research workers employed by wood-using companies depending on local raw materials will, of course, be dictated by local considerations. Peculiarities of the product manufactured plus favorable conditions for concentrating nearby wood waste may indicate the desirability of almost any kind of utilization research. In setting up research programs in the broad field of waste utilization by public and quasi-public agencies, however, consideration should certainly be given to those wastes that are in ample supply, sufficiently concentrated for practical exploitation, and produced by mills that are not likely to exhaust their supplies of operable timber in the immediate future.

Another important economic consideration in selecting a research project in wood-waste utilization is the determination of the kinds and quantities of wood waste available in an operating territory that can be supplied to a given plant at a feasible cost. In some instances, the choice between two otherwise equally meritorious research projects may hinge upon the economic availability of a given kind of waste material. A producer of corrugating board recently wanted to run some tests to determine if hardwood sawmill slabs would produce a satisfactory fiber for his use. He procured an experimental supply from a nearby sawmill. At this point he called in for counsel a man who knew something of the local sawmill industry. This local man recognized at a glance that the species represented in the experimental slabpile were bottomland species and were not at all rep-

resentative of the supply available generally in the territory of the corrugating board mill. Tests run on the experimental slabs, therefore, would not indicate the suitability of the average run of local sawmill slabs for his purpose. He was advised to make a survey of the quantities and kinds of wood waste tributary to his plant, the probable purchase price and transportation cost of each, and to test those kinds that seemed to offer possibility for economic use.

Significance of Improved Equipment

Some of the failure to utilize waste is due to lack of technical processes for making a useful product from material now wasted. To a much larger degree, this failure is due to the lack of cheap, efficient procedures for handling and concentrating widely scattered pieces of waste. Economists are sometimes called upon to assist equipment designers in planning and carrying out time studies to develop machines and procedures for handling and concentrating waste wood. One operator has found that slabwood from small sawmills can be loaded on wood dollies approximately the size of a 1½-ton truck bed. These dollies are spotted at several mills in a given locality and are filled with slabs by the off-bearer at about the cost of piling the slabs on the usual waste heap. Once a day the purchaser's truckdriver loads a full "dolly" on his truck by means of a winch, cable, and a pair of skids. At the same time he leaves an empty "dolly." By a very simple "trial and error" study, this purchaser discovered the combination of equipment and process that provided him with a usable raw material at an acceptable cost.

Summary

Throughout this paper, I have talked about economic considerations in wood-waste utilization research. By this I do not mean to imply that research organizations need be "padded" with "stand-by" economists waiting to give counsel when called upon. A generous amount of clear economic thinking by the chemist, engineer, or other specialist is, however, necessary at the time waste-utilization studies are being planned and carried out. Such thinking should almost always include a consideration of the approximate quantity, character, and distribution of the waste that is suitable for the manufacture of given products, the probable cost of the waste at the consuming plant, and the probable selling price of the products. Consideration of these items may eliminate certain studies and permit the concentration of effort on ones likely to develop processes that can be useful in plant operation and in wood-waste utilization.

Twenty Years' Growth on Yellow-Poplar

A typical yellow-poplar in the Southern Appalachians on a good site during the 20 years while it is growing from a 12-inch tree to a 20-inch tree increases in volume nearly five times. But it increases in net value 28 times during the same period. Increased value is due, not to increased price rates, but to the fact that the 12-inch tree produces 2 logs of No. 3 grade, whereas the 20-inch tree produces 4 logs, of which one is select, one No. 1, one No. 2, and one No. 3.—*R. A. Campbell.*

Watershed Condition and Flood Potential

Howard W. Lull

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A method of computing the expected runoff from a flood-producing storm on the Ephraim Creek Watershed is described in detail. Control measures needed to prevent such floods are suggested.

PREVENTION of destructive, recurrent floods poses the chief problem for watershed management in the Intermountain region. Repeated observations have shown the cause and origin of these floods to be excessive runoff during high-intensity summer storms on overgrazed, deteriorated subalpine ranges (*2, 5*). Quantitative studies have also demonstrated the effectiveness of vegetative cover in controlling runoff and erosion (*4, 8*). As yet, however, a satisfactory method has not been devised by which the flood potential of a watershed may be evaluated. Watershed managers are still faced with the problem of determining the flood hazard of individual watersheds and, where a serious potential exists, they must estimate the extent of the measures that are required to eliminate it. An approach to this problem is herein described, using as an example the watershed of Ephraim Creek in central Utah.

The 16,700-acre watershed of Ephraim Creek is typical of the several watersheds, on the west face of the Wasatch Plateau, which drain into the Sevier Lake basin. These watersheds, now a part of the Manti National Forest, still bear evidence of the severe overgrazing to which they were subjected during the period 1870-1903. It has been estimated that when the Manti Forest was created in 1903 there were 520,000 sheep on the 722,000 acres withdrawn from the public domain; by 1905 this number was reduced to 150,000; the present number is 110,000 (*3*).

The result of the severe overgrazing use was accelerated erosion and summer storm floods. The first flood from the Ephraim Creek watershed occurred in 1889, 37 years after settlement began in the town of Ephraim and a decade or two after the start of overgrazing on the watershed. Ten other floods have poured out of the watershed, the last two occurring in 1936.

The Flood-Source Area

Gully scars inflicted by the flood runoff from this watershed lead unmistakably to the flood-source areas. Most of these are within the herbaceous cover-limestone soil complex, situated in the subalpine zone at elevations above 9,500 feet. There are 1,369 acres of this complex. It is characterized by a vegetation composed of approximately 90 percent forbs and 10 percent grasses. The forbs are mainly *Aster, Geranium, Penstemon,* and *Viola* species. The grasses are chiefly *Bromus, Poa, Stipa,* and *Agropyron* species. The soil, a clay of limestone origin possesses many of the characteristics common to the soils of the rendzina group. The solum, varying in depth from 1 to more than 12 inches, rests on a permeable layer of fractured limestone.

In a detailed survey, the herbaceous-limestone complex of the Ephraim Creek watershed was divided into three condition classes using plant density and extent of visible erosion as class criteria. The survey shows that 419 acres, or 31 percent of this complex, were in a condition defined as Class 1. These sites, interspersed throughout the complex, show no evidence of runoff or soil loss. They have, as a minimum, a 50 percent density of herbaceous vegetation and an additional 15 percent density of litter, or a total ground cover of 65 percent. Areas bare of protective cover on these sites are small in extent and well dispersed.

The Class 2 condition comprises 719 acres or 53 percent of the complex area. Evidence of sheet erosion was observed on 98.3 percent of these sites; 6.7 percent were gullied, and 8.3 percent possessed an erosion pavement. Pedestalling is common on these areas; small rocks and clumps of vegetation are often ¼ to ½ inch above the ground surface. These sites on the average have a total ground cover of 35 percent, of which 30 is of herbaceous plants and 5 is of litter.

Class 3 areas totalled 231 acres, or 16 percent of the complex. All of these sites were sheet eroded, about two-thirds were gullied, and about 90 percent possessed an erosion pavement. As a result of the severe erosion, plant roots were exposed in many places and rocks are perched on soil pedestals as high as 2 inches. The total ground cover characteristic of this condition approximates 17 percent, of which 15 is of herbaceous plants and 2 is of litter.

Runoff and Erosion Characteristics

To determine the flood potential of these watershed condition classes, measurements of surface runoff and erosion were made with a Type-F infiltrometer on two similar 6 x 12 foot plots within each of the three classes. Each plot was twice subjected to an average of 2.44 inches of artificial rainfall in 60 minutes, the second test being made about three weeks after the first. In all tests, rainfall was applied at a variable rate up to a maximum intensity of nearly 5 inches per hour. The volume, maximum rate, and duration of the applied rainfall simulate the average intensity-duration pattern of a summer cloudburst type storm of about a 40-year recurrence interval in this area (*8*).

This simulated storm produced, on an average, 1.8, 13.8, and 73.0 percent runoff from the Class 1, 2, and 3 sites, respectively. It also caused soil losses of 0.05 ton per acre on the Class 1 sites, 0.5 ton per acre on the Class 2 sites, and 5.55 tons per acre from the Class 3 sites. These differences in runoff and soil losses are not unusual. Essentially similar results have been obtained by investigators testing the effect of different kinds and degrees of plant cover on runoff and erosion in many other localities (*7*).

Flood Potential

The infiltrometer tests also showed that the site classes 1, 2, and 3 produced runoff at maximum rates of 0.18, 1.25, and 3.82 inches per hour, respectively. These maximum rates occurred almost simultaneously on all plots some 21 to 22 minutes after rainfall began (Fig. 1). These plot rates are equivalent to discharges of 0.18, 1.26, and 3.85 cubic feet per second per acre of watershed land.

TABLE 1.—COMPUTED MAXIMUM RATES OF DISCHARGE FROM PRESENT SITE CLASS AREAS

Condition Class	Max. rate of plot runoff	Discharge per acre[1]	Site class area	Discharge by area
	Inches/hour	*C.f.s.*	*Acres*	*C.f.s.*
1	0.18	0.18	419	75
2	1.25	1.26	719	906
3	3.82	3.85	231	889
Total				1,870

[1]Calculated from plot runoff values by the formula

$$\text{Discharge per acre} = \frac{\text{Maximum rate of plot runoff} \times 43{,}560}{3{,}600 \times 12} = \text{Maximum rate} \times 1.0083$$

The latter values were multiplied by the acreage of each condition class to determine the magnitude of a flood flow that would be set in motion on the herbaceous-limestone complex if the entire area were subjected to a rain comparable to that used in the infiltrometer tests. These computations show that in the event of such a storm, this complex would produce a maximum discharge of 1,870 c.f.s. (Table 1).

From these calculations, it can be seen that 48 percent of the total discharge would come from the Class 3 sites, which comprises only 16 percent of the total complex area. An additional 48 percent would come from the Class 2 sites, representing 53 percent of the area. The remaining 4 percent of the discharge would come from the Class 1 sites, which comprise 31 percent of the area.

Some of the flood runoff set in motion on the land would be checked and absorbed before reaching the headwater channels. Because of the efficient gully system already established on

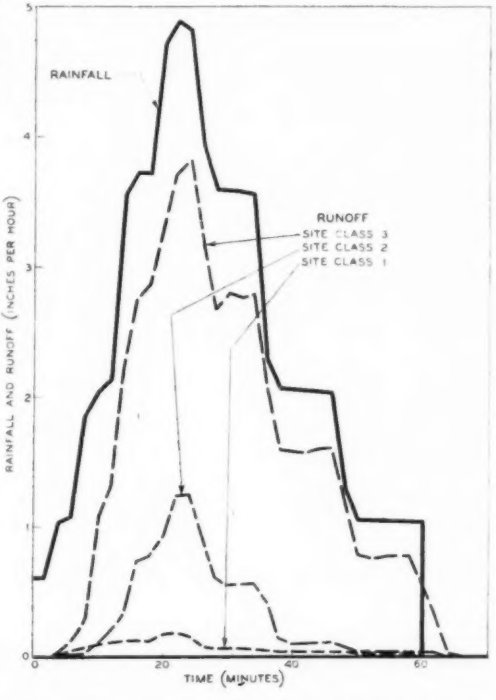

FIG. 1.—Average intensity-duration characteristics of applied rainfall and resulting runoff from 3 site class conditions.

most of the complex, however, the amount of local runoff control would be small. Any such loss in discharge would probably be more than offset by the volume of eroded material carried by the water into the channel system.

A portion of the headwater flood runoff would be stored in the main channel on its way to the canyon mouth. Most of this storage would occur in the 5 miles of low gradient channel at the lower end of the watershed. Here, a lowering of velocity would cause the deposition of the heavier debris and a consequent lessening in the volume of the flood flow. For streams in this area it has been estimated that channel storage will effect a reduction of flood discharges equivalent to about 60 c.f.s. per mile of effective storage channel length. Thus, the 1,870 c.f.s. maximum peak discharge on the land would be reduced to about 1,570 c.f.s. by the time it reaches the mouth of the watershed.

This calculated discharge would produce a flood of greater magnitude and damage than all but the greatest flood of record in this watershed. On the basis of estimates developed by a detailed flood control survey (*6*), flood damage to rural and urban property from such a discharge would total about $26,000 (Fig. 2).

Reduction of Flood Potential

After determining the flood potential and its seriousness, the next step was to estimate what watershed conditions are necessary to correct the situation. Partial improvement of the area, by converting the 231 acres of the site Class 3 area to a Class 2 condition, would reduce discharge by about 50 percent. Full protection, to keep the discharge below a safe maximum of 300 c.f.s., would involve changing all but 277 acres of the present Class 3 and Class 2 condition areas to a Class 1 condition. The complex area would then consist of 1,092 acres in a Class 1 condition, and 277 acres in a Class 2 condition. The magnitude of the calculated discharges resulting from partial improvement and full protection are shown in Figure 2.

Setting up flood protection requirements necessitates considering the possibilities of attaining them. Two questions must be answered affirmatively: First, did the Class 2 and 3 sites ever support a vegetation of a density comparable to the Class 1 areas? Secondly, is it possible to convert the Class 2 and 3 sites to a stabilized condition?

The answer to the first question in so far as the Ephraim watershed is concerned lies in the very existence of the soil mantle. At the present rate of erosion, the soil on these sites is being removed faster than it is being formed. If this were a normal process, there would be no soil on these sites to erode. Obviously, at one time the soil had been formed under a stabilized condition, and, as stabilization in this complex requires the plant density found on the Class 1 sites, it is reasonable to assume that the Class 2 and 3 sites supported a pristine vegetation with a ground cover of about 65 percent. Ellison, who has made a detailed ecological study of this complex (*3*), described the condition of the original vegetation as follows:

"The cover density of vegetation and litter was undoubtedly well in excess of 50 percent . . . and probably was on the order of 70 percent even in rather dry situations. Vegetation and litter were uniformly dispersed, with bare spaces small and scattered, in contrast to patchy vegetation that occurs in many places today, with bare eroding soil between patches. Observable erosion of the surface soil was absent throughout practically the entire community."

Restoration of sites as deteriorated as those in Class 2 and 3 condition poses a difficult and costly problem, though not a hopeless one. Contour trenching to break up the gully system and hold rainfall where it falls, together with artificial reseeding and protection from grazing, resulted in the prevention of summer storm flood runoff in northern Utah (*1*). Comparable results should be attainable on the Ephraim Creek watershed through adaptation of these measures. Until such steps are taken, damaging floods are certain to continue in the Ephraim Creek drainage basin.

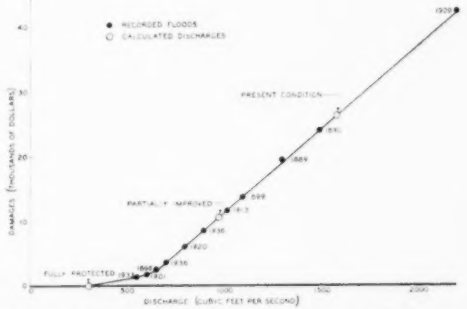

FIG. 2.—Relation of damages to past flood discharges and relation of calculated damages and discharges under present and improved site class conditions.

The system of recognizing classes of site deterioration and of assigning runoff values to them as described above provides a method of determining the flood potential of a drainage basin and the extent of improvements needed for controlling destructive summer storm runoff. A similar approach should prove helpful in determining watershed protection requirements in other basins where summer storm runoff is a serious hazard to downstream values.

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Announcement of Fellowships Administered by the National Research Council

THE Fellowship Office of the National Research Council announces that applications for fellowships in the natural sciences are now being accepted for consideration at the spring meetings of the Fellowship Boards.

The fellowship programs are supported by the Rockefeller Foundation, the Radio Corporation of America, Merck and Company, the Carnegie Corporation, and the Atomic Energy Commission, and administered by the National Research Council. These provide for both predoctoral and postdoctoral research by U. S. citizens (in one case, Canadian citizens are eligible). Fellowship work may be pursued in the physical, biological, agricultural, and basic medical sciences, including Engineering, Anthropology, and Psychology. One program provides special training in the social sciences for persons with doctorates in the natural sciences, or training in the natural sciences for persons with doctorates in the social sciences.

The basic stipends for the predoctoral fellowships range from $1,500 to $2,400 per year; the basic stipends for the postdoctoral fellowships range from $2,500 to $5,000 per year. The stipend in each case will be determined by the appropriate board, with consideration given to the amount of training, marital status, number of dependents, etc. All programs provide for necessary tuition and fees in addition to the stipend.

For application blanks and full information, address the Fellowship Office, National Research Council, 2101 Constitution Avenue, Washington 25, D. C.

Top Dying of Conifers from Sudden Cold

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Western foresters have occasionally been alarmed by the sudden and unexpected appearance of dead tops on thrifty pines. Since insects are a common cause of top-killing in conifers and are often found in the dead pine tops, the killing is usually presumed to be of insect origin. From the investigations reported here it is apparent that sudden temperature changes resulting in killing of bark in the tops is sometimes the primary cause of such dieback, even at temperatures well above those normally considered to be damaging.

In March, 1944, officers of the Arroyo Seco District, Angeles National Forest, California, noted that tops of a number of exposed Coulter pines (*Pinus coulteri* D. Don) and a few big-cone-spruces (*Pseudotsuga macrocarpa* [Vasey] Mayr) around Charlton Flats were beginning to fade. This was while snow from one of the heaviest falls on record for the area still covered much of the ground. By late summer hundreds of tops on trees of all sizes were dead and on many of these trees additional whorls of branches below the original limits of dying were fading. Scattered trees were completely dead.

A preliminary field examination of the effected area was made in November, 1944 by Senior Entomologist F. P. Keen, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, and the writer. By this time several hundred of the dead Coulter pine tops had been removed and were available on the ground for examination.

Representative dead tops were found to be sparsely infested with insects, for the most part species of bark beetles ordinarily regarded as secondary, such as *Ips latidens* Lec., *Pityophthorus* sp. and *Orthotomicus* sp. From the distribution of these insects in the tops, as well as from their known habits, it did not appear that they could have been primarily responsible for the top dying.[1] Instead, resin infiltration in the bark and the presence there of abnormal parenchyma tissues below the zone of killing suggested a physiogenic origin. This possibility was later explored by the writer, both in the field and laboratory, in the course of which killed tops were found with no insects present and no evidences of insect work.

The trees in the affected area grow in a very open formation, with their crowns well isolated, for the most part, from one another. Those that suffered top injury were nearly all young and thrifty, and making rapid growth, both in height and diameter. Heights varied roughly from 15 to 100 feet. Dieback was most pronounced in fully exposed situations, such as ridge tops, south slopes, and places where individual tops projected well above the level of surrounding trees. Even in such locations, however, many exposed tops remained green. Conversely a few trees, mostly from 10 to 20 feet in height, had died completely by the end of the season.

In all affected trees the injury was found to show the same general characteristics, varying only in degree and extent. It was present not only in trees with killed tops but also in many with the foliage still completely green. One intermediate case was noted in which the 1940-1943 growth at the tip was still green, though both bark and cambium were dead several feet below. Some of the branches from the dead portion were still alive. In a number of trees the branches of one or more whorls below a dead top were alive although the bark and cambium of the main stem bearing them were dead at that level. The length of top killed was quite variable from tree to tree, ranging from only 2 or 3 feet to 15 feet or more. Stem diameters at the base of the killed portion averaged about 5 inches but in a few trees were as much as 10 or 12 inches.

The wood of the 1943 growth ring appeared normal in every case, indicating that the damage occurred after the completion of growth for that season. Near the base of the dead portion of typical killed tops a zone of resin-infiltrated bark from one to two feet in length was characteristically found. In most cases some external resin flow had occurred from the lower portion of this zone earlier in the season but was not active at the time of the examination. From the lower portion of the zone of resin infiltration on down the stem the cambium was alive and narrow layers of new wood and bark tissues had been produced in 1944. Outside of the new layer of phloem, in most cases examined, was a layer many cells wide of compressed, browned, and

[1]Keen, F. P. Examination of Angeles Crest highway infestation. Memorandum, Berkeley Forest Insect Laboratory. 2 pages, November 10, 1944.

resin-infiltrated older phloem tissue with a pronounced lateral displacement of the elements from their normal radial position. At the outer edge of this layer the former phloem had been ruptured and separated, sometimes to a width of as much as 0.5 mm. This space had filled with a very loose, open parenchyma, set off by an irregular zone of cork cells. The bark was found to separate readily along this loose parenchyma and the part outside could be pulled off in long strips.

This pattern of killed, injured, or abnormal tissues extended on down the stems of affected trees for varying distances, gradually becoming less pronounced and merging finally into normal bark. Green but injured tops showed abnormalities of the same character but in less severe form, with no killing of the cambium. It was evident in every case that the major injury had been to the live, inner bark tissues. Little initial injury was found in live branches emanating from killed portions of main stems. Where present, it usually consisted of killed patches in the outer, live bark near the base of the branch. In one or two instances, lenticular-shaped islands of live cambium several inches long were found around the bases of live branches on otherwise killed portions of main stems.

Prolonged drought, especially when extending late into the fall, has been known to cause a top dieback of conifers, such as occurred in northern California and southern Oregon in 1930 and again in 1937, but the 3-needle pines are ordinarily very resistant to dieback from this cause. Coulter pine normally occupies habitats for which dry periods of considerable length are characteristic. Rainfall from April through November of 1943 was quite deficient, totaling only 1.35 inches as against a normal of 5.60 at Mount Wilson, a few miles from the affected area. However, about one inch of the total fell in October and this should have been sufficient to prevent any drought dieback on pines. More positive evidence that drought was not involved was provided by the character of the injury itself, which was quite different from that to be expected from drought (*2*).

The evidences of compression found in the injured phloem and the layer of loose parenchyma tissue formed outside of it are, however, phenomena commonly associated with the action of low temperatures on tissues not fully dormant in trees (*9, 11*). Jackson (*7*) has reported transverse rupturing within the bark of boxwoods from cold in December following warm fall weather, and Grossenbacher (*6*) has found the same type of injury in fruit trees. Compression is brought about by the unequal contraction in the bark and wood when the bark freezes, sometimes aided by the pressure of ice formed in the intercellular spaces. The loose parenchyma is laid down later, after the thawing of the outer tissues results in less than normal pressures within the bark.

Temperature records read several times daily for most of the winter were available from Vetter Mountain Lookout in the midst of the affected district. They indicated that November was somewhat warmer than normal but that December was cool, with much rain and with snow on several occasions. Early January was cool but on January 12 a period unusually mild for mid-January at nearly 6,000 feet elevation began and continued until the evening of January 23. Temperatures read at 6 a.m. (Pacific Standard Time) varied from 40° to 52° F. and those at 11 a.m. from 46° to 60° F. during the period. From comparisons with thermograph readings on the San Dimas Experimental Forest, some miles to the east, it appeared that on 4 or 5 days during this mild weather maximum temperatures on Vetter Mountain must have been in the neighborhood of 68° F.

From 42° F. at 11 a.m. on January 23 the temperature dropped to 31° at 9 p.m., 22° at 6 a.m. January 24, and 21° at 10 p.m. that evening. The drop was accompanied by strong winds and was followed by the heaviest snowfall on record. The weather for the balance of the winter remained cool for the location, with the ground snow covered into April.

A mild period of 11 days in midwinter, especially in conjunction with the effect of the ample moisture supplied by the December rains after the long, dry summer and fall, might well induce physiological changes in the tissues of exposed conifers that would increase their susceptibility to cold injury. It is well known that resistance to cold in plants is influenced very much by the environmental conditions surrounding them preceding the exposure to cold. Day and Peace (*5*) were able to raise the critical temperature for injury in young, potted Norway spruce by 5° F. by exposing them for 5½ days early in April to a temperature of 70° F., followed by freezing temperatures. It is also known (*3*) that chemical and physiological changes influencing its

susceptibility to cold injury take place in a conifer prior to the actual initiation of growth.

No evidence could be found in the tops of the Coulter pines on the Angeles that any active growth had taken place preceding the injury. When freezing of tissues occurs while the cambium is in an active state, as is ordinarily the case in late spring frosts, the injury normally centers in the cambial region (*9*). The well known "frost ring" is formed as a result. In injured but unkilled tops on the Angeles, however, no pronounced distortion of cells in the cambial region was found. Rupture of tissues and the subsequent filling in between the ruptured layers by loose parenchyma tissue took place farther out in the phloem, as already described. This fact, the compressed and darkened condition of the phloem within the zone of rupture, and the wide band of loose parenchyma developed between the ruptured tissues suggest that the damage resulted from a combination of direct freezing injury to the inner bark, rendered sensitive by the preceding warm weather, plus the pressure changes from unequal contraction of the bark and wood during the freeze and unequal expansion in the subsequent thawing.

It is very probable, as indicated by the tree already cited in which the upper part of the top was found to be still alive in November, 1944 though the stem was dead lower down, that not all of the live tissues in the tops were killed from the immediate effects of the sudden cold but died later in consequence of isolation by the death of tissues below. If an examination could have been made sooner after the damage occurred, more definite evidence on some of these points could no doubt have been obtained. Regardless of the details of how the killing took place, however, there seems no question but that it was occasioned primarily by the effect of sudden cold.

The well-known differences between individual trees, such as in the readiness with which they break dormancy, as noted by Münch (*8*), should account for the fact that many fully exposed trees escaped appreciable damage while others nearby were seriously affected. Coulter pine is known to be less hardy than most other pine species and in Germany, according to Beissner-Fitschen (*1*), it must have side protection against sun in winter and spring to avoid winter injury. In addition, the weather is ordinarily very mild in the locality around Charlton Flats where the top killing occurred. In consequence a local race of the species, adapted to these normally mild conditions and less hardy than other races growing on colder sites, has no doubt developed there.

The conclusion that top dying in this instance on the Angeles was brought about by the unsuspected action of cold at temperatures well above those at which injury to pines would normally be anticipated may have more than local significance. From time to time in the past, unanticipated top dying of conifers has appeared in other forested districts in California, as reported by Salman (*10*). He noted that the thriftiest trees seemed to suffer from the top dying more than the less thrifty and in the absence of any other evident primary cause he attributed the damage to two species of *Pityophthorus*, *P. confinis* Le C. and *P. confertus* Sw., though these insects had not previously been known to cause such damage. However, he stated, "it is possible that the trees had previously been weakened and their resistance to insect attack reduced by some other environmental factor. If such was the case, that factor could not be determined."

The probability that this dying was initiated by cold injury and that the insects were secondary invaders is suggested not only by features concerning it observed by the present writer at the time on the Stanislaus National Forest but also by top killing of the same general character investigated on the Lassen and Plumas National Forests in 1947 after it had been brought to our attention by Veldon Parker of the Forest Service. He noted that on the Lassen National Forest the damage was confined to ponderosa pine (*Pinus ponderosa* Laws.) surrounding several open flats on the eastern portion of the forest and did not extend far up adjoining slopes. The trees affected were for the most part the taller thrifty dominants of 100 feet or more in height but in places occasional tops of vigorous younger trees, where these were fully exposed, had also died back.

An examination of sample affected tops from two areas showed that they had been making strong growth prior to the injury, that the injury centered in the inner bark of the main stem and larger side branches and that insects had played little or no part in the dieback. In each case, damage to the inner bark extended below the level where the top was completely dead. Most of the killed bark was heavily infiltrated with resin, while in the portions injured but not

killed there was unmistakable evidence of freezing injury in the form of a ring of loose parenchyma tissues, as in the specimens from the Angeles Forest, and in openings and other deformations in the inner phloem tissues resulting from the formation there of ice crystals. Externally, more than normal amounts of resin were present on the surface of the bark and over injured portions where the cambium was still active the bark was cracked and roughened in consequence of growth under the killed tissues. Day (*4*) has found similar resinous and roughened bark as characteristic external signs of frost injury in Corsican pine in England and Wales. He also found that the killing of bark tissue was a common accompaniment of this type of injury and that damaged stems were often later invaded by bark beetles.

No source of detailed weather records could be found within the localities where the top-dying occurred from which conclusions might be drawn concerning the conditions under which it took place. Thermograph readings from the headquarters of the Blacks Mountain Experimental Forest, some sixteen miles distant from the closest affected area, suggested that the injury probably occurred during October, 1946 either on October 4, when the minimum temperature at the Blacks Mountain headquarters reached 22° F. and remained below 30° F. for 11 hours, or during October 28-29, when minimums of 7° and 9° F. respectively, were recorded. Temperatures within the affected areas were probably more extreme. Even so, they would be likely to cause injury in the bark tissues only when the latter were not in a completely dormant condition.

Top dieback not traceable primarily to insects and with resemblance to freezing injury appeared in the spring of 1946 on occasional ponderosa pines and several incense-cedars (*Libocedrus decurrens* Torr.) in a foothill belt at about 2,000 feet elevation near Placerville, Calif. In every instance noted, the affected trees had been vigorous specimens, either standing in the open or with fully exposed tops projecting well above surrounding trees. An injured ponderosa pine top in the early stages of fading at the tip was made available to the writer for examination through J. M. Miller of the Berkeley Forest Insect Laboratory, Bureau of Entomology and Plant Quarantine, after he had determined from a preliminary examination that almost no insects were present.

Below the killed portion of the top the inner bark was dead in part and the portion not completely dead showed a browning that gradually diminished in intensity down the stem. Occasional separations in the bark tissues, forming small arcs parallel to the cambium, were at first thought to have been caused by freezing, though not quite characteristic for freezing injury as seen elsewhere in pine tops. However, thermograph records from near a severely damaged tree on the grounds of the Institute of Forest Genetics, U. S. Forest Service, disclosed no periods in which it appeared likely that freezing injury to conifers could have occurred, even though the evidence from the trees themselves suggested that the trouble was probably climatic in origin. A satisfactory explanation for the damage must await the results of a more intensive investigation of similar instances that may occur in the future.

While the other cases cited definitely point to the advent of sudden cold snaps as an unappreciated cause for top dying in species of conifers usually considered to be quite resistant to cold injury, it must be recognized that the more familiar sources, such as insect attacks and drought, are still operative in our forests. Dieback from freezing injury is to be suspected when the dying appears early in the season without an evident source or any preliminary losses and when only thrifty trees with tops fully exposed to the sun are affected. It is to be especially looked for if the preceding fall or winter has been marked by a sudden change from warm and sunny to unusually cold weather.

The presence, particularly in some areas, of old dead tops on vigorous trees suggests that climatic conditions resulting in damage have occurred there at times in the past though the indications are that such occurrence has not been frequent. Reliable evidence on this point must await future records of authenticated cases.

Summary

Top dying in Coulter pine on an area in California was found to be confined to fully exposed tops of thrifty trees and could not be ascribed to insects present. Characteristic freezing injury was present in gradually diminishing intensity below the dead portion of affected tops, accompanied by heavy resin flow from a zone just below the limits of complete killing. Similar but less pronounced injury was found in the inner bark of sample live tops.

Weather records from within the affected area indicated that the top dying had resulted from freezing injury accompanying a quick drop in temperature to approximately 20° F. following an abnormally warm period of eleven days in January.

Similar freezing injury has been found in connection with top dying of ponderosa pine in northern California and may have been the primary cause for earlier top kill in this species ascribed to Pityophthorus beetles. Cases somewhat resembling freezing injury, with accompanying top dying, have been noted where no low temperatures occurred.

Freezing is to be suspected as a cause when top dying appears early in the season and is confined to fully exposed tops of thrifty trees.

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Proceedings 1948 meeting

ALL papers presented at the annual meeting held in Boston December 15-18, 1948, will be published in a separate volume of proceedings. Because of high printing cost it will be impossible to provide each member with a free copy. The price of the *Proceedings* for members will be the cost of publication and mailing, $2. Cost to nonmembers will be $3.

To avoid overprinting, only a limited number of copies will be published. Accordingly, every member desiring the *Proceedings* of the Boston meeting should notify the Society promptly in order that a copy may be reserved for him.

Notes

Mississippi State College Offers New Major in Agricultural Forestry

Mississippi students can now obtain for the first time a bachelor of science degree in agriculture with a major in agricultural forestry, according to an announcement by President Fred T. Mitchell of Mississippi State College.

The Board of Trustees of the State Institutions of Higher Learning approved the new agricultural forestry curriculum which had been prepared by the School of Agriculture.

This new agricultural forestry major is the third step forward in forestry education made by the School of Agriculture since the new Department of Forestry was created in 1945. The first of these was the offering of four farm forestry courses designed to acquaint all agricultural students with the management of farm woodlands. The courses are farm forestry, farm woodland management, silviculture, and forest resources. The second was the setting up of a two-year preforestry curriculum for those few students in Mississippi who wanted to become professional foresters. Now forestry is placed on a par with the other nine fields of agriculture in which a student working for a degree in agriculture may major.

According to Professor Monty Payne, head of the Department of Forestry, "This new agricultural forestry course gives the School of Agriculture another first in the field of agriculture forestry. Mississippi State College is the first land-grant college to offer a degree in agriculture with a major in agricultural forestry. This college was also the first to require the major portion of its other agricultural students to take six hours of farm forestry. Under this new setup an agricultural forestry major will get off thirty-hours of forestry and thirty-one hours of pure agricultural subjects.

To enable the students to learn forestry first hand in the woods, doing the job of mapping, surveying, cruising, marking, harvesting and marketing timber, plans for holding two eight weeks forestry camps have been formulated. One camp will be held in February and March on the University Forest in the longleaf slash-pine belt, the other will be held in April and May in the shortleaf-loblolly pine, upland hardwood region on the 88,000 Northeast Mississippi Land Utilization Project and Wildlife Refuge in Choctaw, Winston, Oktibbeha and Noxubee Counties.

Other facilities available for research work, student instruction and demonstration work includes the 3,100 acre Northeast Mississippi Experimental Forest and the Pilot Farm Woodland areas on and adjoining the College campus.

There were 275 agricultural students taking farm forestry courses during the fall semester, 12 freshmen and six sophomore preforestry students taking the two-year preforestry course, and 20 men who have completed the two-year course and are now getting off the last two years and one summer of professional training at other four-year professional schools.

Prof. Payne estimated that there will be from 25 to 50 students registering for the new four-year agricultural forestry course each year.

Does Burning Increase Surface Runoff?

A booklet on hydrologic aspects of burning brush[1] was recently reviewed by E. N. Munns (Jour. Forestry 45:688-89, 1948). The broad findings and conclusions were covered but some of the specific findings and the methods which lead to these findings need further critical inspection.

The objective of the publication was to review published literature, unpublished manuscripts, and opinions on the hydrologic effects of burning brush and woodland-grass ranges and on subjects related to the burning problem. The authors have made an analysis of the problem, collected and presented a large mass of data related to the problem, and made recommendations toward solution.

They came to the following conclusions: (1) Conflicting evidence exists as to the effect of burning on runoff and erosion. Soils, topography, rainfall intensity, and vegetative recovery vary widely; so burning can be neither sup-

[1]Adams, Frank, Paul A. Ewing, and Martin R. Huberty. Hydrologic aspects of burning brush and woodland-grass ranges in California. 84 pp., illus. California State Board of Forestry, Sacramento. 1947.

ported nor condemned for all conditions and situations in California. (2) No adverse effect of burning on water conservation was found in experimental data from northern California. In central California increases in runoff following burning were noted, but whether this would reduce usable runoff is not clear. (3) Expansion and coordination of research is needed. The public must be willing to wait through the long periods necessary to get answers to hydrologic problems.

They recommended: coordination of all research to the end that agreement on techniques and procedures be reached which would permit valid comparison and interpretation of the results; that whole watersheds be studied; that periodic burning and its effects be studied; and that a hydrologic observer be appointed to watch the effects of burning.

In his review of the paper E. N. Munns has said that the analysis was well done but he had a feeling that Adams et al. might have done better. The writer agrees and would like to point out some of the strengths and weaknesses which are found in the method of analysis and in the hydrologic factors which the authors considered.

In their analysis the authors utilized only those data which they considered "fairly analogous to conditions on the California ranges . . ." For example, the wealth of data from southern California watersheds was eliminated from consideration because the areas were not grazed. By this approach they avoided the possibility of drawing unjustified conclusions, but restricted the possibility of developing tentative answers to the problem from findings in outside areas.

The hydrologic problems considered by the authors were: (1) The effects of burning on factors influencing flood and erosion problems and (2) the effect of burning on factors influencing water conservation. These are undoubtedly the chief problems; however, in evaluating the full effects of burning, the problem of long-time effects of repeated burning on productivity of the site should also be considered, and the abstraction "water conservation" should be broken down into the specific items: quality of water, sustained streamflow, and total water yield.

The authors correctly point out the necessity for evaluating areal, topographic, soil, and rainfall differences which cause variations in the hydrologic effects of burning. But, in studying rangelands, variations in hydrologic effects arising from differences in natural cover and fire conditions during burning should be considered, as well as variations arising from management practices following burning, including grazing practices, terracing, and seeding.

This writer believes that some of the data and factors not considered by the authors would help clarify both the current findings quoted in the publication and the needs of future research. For example, the apparent contradiction in the author's conclusions—that there is evidence showing that burning increased surface runoff and erosion and contrary evidence indicating that it does not—may be clarified by the simple expedient of considering natural cover differences given in the data cited.

The data presented by the authors showing that surface runoff was not accelerated by burning brush vegetation were chiefly the findings of F. J. Veihmeyer. In arriving at this negative conclusion as to burning effects, Veihmeyer used the surface runoff of an unclassified and unweighted sample of four different cover types. The sample consisted of 23 plot-years of the chamise cover type, with only 8 plot-years of manzanita and manzanita-oak, 7 of manzanita-oak-pine, and 6 of the scrub oak. In Veihmeyer's experiment the chamise type dominated.

Since these cover types occur in localized areas and may be subject to burning as distinct units, classification of them into cover types before analysis would seem proper. Or, if all types were to be considered together, a weighted average should be taken. In the writer's opinion, failure to do either has led to wrong conclusions.

If Veihmeyer's data from tables 9, 10, and 11, pages 61, 64, and 65, are rearranged and runoff compiled by cover types for burned and unburned paired plots, a very different conclusion must be drawn from the experiment. Such a rearrangement is shown in Table 1.

In this form, for all types except chamise, the "contrary" evidence that burning does not increase surface runoff becomes concurring evidence that it does increase runoff. For cover types other than chamise, the surface runoff from the burned plots was from 1.3 to 14.8 times as much as that from the unburned plots and averaged 1.45 times as much for all types. Similar results were obtained in a reanalysis of the erosion data from the same source, since erosion was closely related to runoff.

TABLE 1.

Cover type	Average annual precipitation[1]	Plot-years	Average annual surface runoff		Ratio
			Burned	Unburned	Burned/ Unburned
	Inches	*No.*	*Inches*	*Inches*	
Chamise	35.6	23	3.30	3.62	0.91
Manzanita and manzanita-oak	30.9	8	1.82	1.37	1.33
Manzanita-oak-pine	28.0	7	2.17	0.61	3.28
Scrub oak	29.2	6	0.93	0.06	14.81
Average (unweighted)	30.9		2.05	1.41	1.45

[1]Average of precipitation at Redding and Red Bluff, Calif.

As for the chamise plots, the runoff differences between burned and unburned plots were small, and it is possible that the effects of burning were obscured by inherent differences which existed between the plot-pairs before one was burned. This possibility is further indicated by the fact that one of the plot-pairs showed a reverse effect. As Adams et al. point out, it was unfortunate that no calibration was made of the plots of this and other studies before burning. Burning of chamise types in other studies cited by the authors—table 7, page 46—showed large increases in erosion, but these data were from southern California and were not considered by the authors in arriving at their conclusions.

Veihmeyer's data show increased surface runoff following burning for all types except chamise. Other findings indicate increases for all types including chamise. Therefore, the writer believes that had the authors considered the data by cover types they would have been led to the definite conclusion that burning increases surface runoff. However, such a conclusion is by no means an answer as to whether or not to burn. The hydrologic effects of burning are only a part of the whole problem; that is, the proper evaluation of the economics of burning.

Studies of many phases of the economics of burning have already been started, but the problem is complex. Burning must be evaluated as to the net effects it will have on the watersheds and the people involved. The immediate values produced in terms of forage must be compared with the cost of the burning to the rancher and the State, and with the cost of property damages resulting from escaping fires. The effect of burning on water yield, sustained water supply, water quality, and flood damages must also be appraised. As the authors state, the problem varies locally and should be locally appraised; yet the effects of burning on people and property distant from the burn cannot be ignored. The problem is immediate; yet the long-time effects of burning on the productivity of the site, the storage capacity of soils, and other factors which influence the future hydrologic problems must be faced.

Basic to the evaluation of the economics of burning is the additional research into the physical effects of burning which Adams, Ewing, and Huberty emphasize as necessary. Their recommendation that whole watersheds be studied is fundamental. Such studies usually require many years for the accumulation of adequate data. However, with the results of basic research to serve as a guide, statistical methods of analysis promise to give reasonable answers to hydrologic problems on a whole watershed basis, and yet minimize the long wait for answers.

To apply these statistical methods in evaluating watershed management practices the most critical needs are for more rainfall and stream-gaging records, extensive inventories of the watersheds, their geology, soils, topography, and vegetation cover, together with accurate records of fires, grazing, and other land uses. Much of this has been started; the factual bases for watershed management are developing.

The paper by Adams, Ewing, and Huberty has brought together much of the literature directly related to the problem of burning of northern California ranges. Together with the companion paper by H. L. Shantz, "The Use of Fire as a Tool in the Management of Brush Ranges of California," it has served to point out many aspects of the problem and the direction that future research should take.

The California State Division of Forestry in its expanding interest in brush burning problems has taken the proper first step by obtaining reviews of the present findings related to

the problem and showing the need for further research.

HENRY W. ANDERSON,
U. S. Forest Service.
Member S.A.F.

Stem Surface Area Determination of Nomograph

Foresters, botanists, ecologists, and other workers in the field of plant science may be faced with the problem of determining the stem surface area of a plant. The plant may be large or small—it may be a petunia, a *Photinia*, or a pine; nevertheless the job involves many measurements, and eventually many calculations.

While studying the interception of rainfall by chaparral vegetation in southern California, it was necessary to measure the woody portion of the shrubs in order to determine the surface area available for the storage of rainfall. The task of measuring stem diameters for the study was tedious, and the prospect of many sheets of computations seemed even more tedious. James Martin, the technician charged with the job, preferred to short-cut the calculating job by constructing a nomograph or alignment chart which would give the required areas by a few movements of a ruler. This nomograph is shown in the accompanying figure.

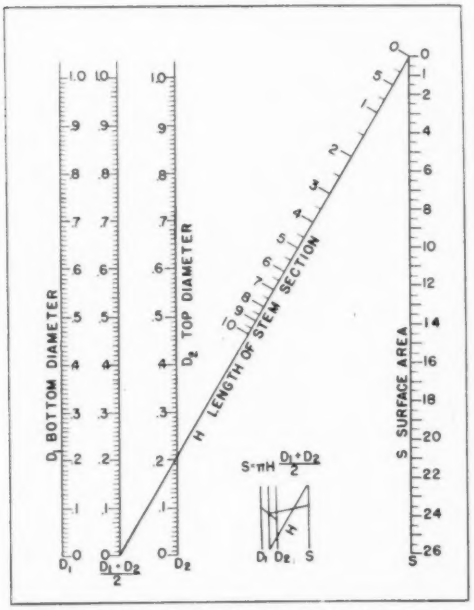


FIG. 1.—Nomograph for the determination of stem surface areas.

In practice the length of stems, branches, and twigs is measured in sections having as uniform taper as possible, after which the end diameters of the sections are measured by calipers. In using the nomograph the diameters D_1 and D_2 of each section are averaged by placing a ruler across the appropriate scales at the left, and noting the mean on the center scale. The ruler is then placed on this mean and swung to the section length on the diagonal scale H, and the surface area is read on the scale S at the right.

E. L. HAMILTON,[1]
Member, S.A.F.

[1]California Forest and Range Experiment Station, maintained by the Forest Service, U. S. Department of Agriculture, in cooperation with the University of California at Berkeley.

Forestry Education in the Junior College

Never before has there been such a searching study of unmet educational needs. When we recognize that the future of our civilization depends on the direction taken by education today and tomorrow, it is most important that our educational system serve American youth wherever they are and whatever their needs may be.[1] As recently as February 18, 1948, President Conant, speaking before the closing session of the United States Conference of Mayors in New York City, contended that our survival depends primarily on vigorous demonstration in the next decade that we can make our form of democracy function in a war-torn world. He stated most emphatically that if this objective is to be realized, education at all levels must be provided and there must be the highest type of professional cooperation. If we are to have education for survival, we must provide needed educational institutions and effective cooperation among them.

Junior colleges are playing an important role in the education of our youth. Over 600 junior

[1]Cotton, Dana M. Relationships of the junior college to colleges and universities. Junior College Journal, May. 1948.

colleges are now operating in the United States. Need for more exists. Many are found on the west coast where the principle of public support has been generally accepted for a long time. Cost to the college and service to the student are such as to provide effectively "something beyond the high school" for the American youths and adults.

Conservation of many natural resources, particularly soil, water, wildlife, timber, and recreational values are directly or indirectly dependent upon wise forestry practice, yet how many people in the United States today know what sound forestry involves? If we are to make the nation really forestry minded, we must implant forestry into the minds of as many young people as possible. Our educational system must inform future timber operators and loggers regarding the methods and value of sound forestry practice. Today timber operators in general still do not know how to perform their cutting operations efficiently and still protect existing young growth. Future operators should learn to correct this.

Why leave forestry education entirely to the big colleges and universities where tuition and other expenses are so high that such education is prohibitive to many who could profit from it? The 600 and more junior colleges that are well distributed throughout the United States can and should share the burden of forestry training. Many of these colleges might well give sub-professional work in forestry. Provisions should be made for those who wish to become timber cruisers, forester's assistants, loggers, timber operators, assistants in woodusing industries or woods foremen to receive the type of education they need within a period of two years following high school. The time is coming when more sub-professional than professional men will be needed in forestry. Many professional foresters today are performing duties that require only sub-professional training. Men with 4 or 5 years of professional training are often reluctant to accept apprentice jobs in logging camps. Yet in these down-to-earth jobs much can be done to further good forest practice.

Every junior college in the country should give some instruction in forestry. Students who plan to become professional foresters should be given basic forestry along with the foundation courses. At the end of their first two years in college they should have the background to decide whether or not to continue in forestry.

With the cooperation of Dean Dana of the University of Michigan and Professor Herbert of Michigan State College, we at the Grand Rapids Junior College have developed curricula which consist primarily of courses given by these two institutions in the first two years of study. Upon graduation our students may enter those institutions or other forestry schools as juniors. We grant a diploma with the title, "Associate in Forestry." Students planning to become professional foresters take general botany, systematic botany, general zoology, English, speech, mathematics, a year of chemistry, a year of physics, economics, American government, engineering drawing, surveying, sociology or psychology, and physical education in different departments of the college. In the forestry department at the present time, the students take introductory forestry, forest mensuration, basic silviculture, and dendrology.

Many students now enter Grand Rapids Junior College with the intention of becoming professional foresters and completing their work in a certain university or senior college. The student may wish to specialize in furniture manufacture, lumber and housing merchandising, utilization, or forest management. All entering students are required to specify in what institution they plan to complete their work for a degree. The catalogue of that institution is then consulted and a course of study is planned for the student which will fulfill as nearly as possible the requirements of the first two years of the senior institution. By substituting three or four more courses in forestry in place of certain basic courses, a two-year sub-professional course may be offered those desiring it. Such a course has not yet been established in the Grand Rapids Junior College but doubtless will be in the near future. At the present time 42 of the 1,200 students attending the college are taking the pre-professional forestry course. Each year more new students enter who plan to become foresters. It was anticipated that the enrollment in forestry this fall would decline but instead it increased. This increase is partially due to an active forestry club organized to further instruction in forestry through movies, outside speakers, and field trips to woodusing industries, the Manistee National Forest, and other timbered areas.

The splendid city and county parks and the many woodusing industries in and near Grand

Rapids make this locality favorable for study in forestry. Field work is done in woodlands owned by the city, county, and private concerns. The Manistee National Forest is only 35 miles from Grand Rapids. Help is given students to obtain summer work in forestry or in forest industries. Many work with the U. S. Forest Service in the Rockies, and on the west coast, in logging camps, sawmills, furniture factories, and in other woodusing industries.

We are attempting to do our utmost to satisfy educational needs beyond the high school for youth in this and surrounding communities. Other junior colleges throughout the nation are doing likewise.

WILLIS E. CHASE,
Grand Rapids Junior College.
Member, S.A.F.

Prevention of Deterioration Abstracts

THE NATIONAL Research Council of the National Academy of Sciences (Prevention of Deterioration Center, Room 204), 2101 Constitution Avenue, Washington, D.C., offers the *Prevention of Deterioration Abstracts* on a yearly subscription basis. These abstracts are classified under the following headings: Biological Agents; Electrical and Electronic Equipment; Fungicides and Other Toxic Compounds; Lacquers, Paints, and Varnishes; Leather; Lubricants, Metals; Miscellaneous; Optical Instruments and Photographic Equipment; Packaging and Storage; Plastics, Resins, Rubbers, and Waxes; Textiles and Cordage; Wood and Paper. Cross references are included in each issue; author and subject indexes are compiled at the conclusion of each volume. Material for the *Abstracts* is obtained from journal articles, patents, and unpublished reports from government, university, and industrial research groups both here and abroad.

Approximately 2,000 pages are published a year, in two volumes of six issues each. The individual abstracts are in loose-leaf form so that they may be arranged in any manner desired by the individual receiving them. Comments are added to many of the abstracts to correlate relevant information, to evaluate reports, or to make suggestions for further research.

The yearly subscription rate, which includes two sturdy binders and index guides, is currently $37.50. The rate will be $50 for requests received after July 1, 1949. All subscriptions run from July 1st to June 30th. Back issues are available from April 1946 when the series was started.

An *Advance List*, a monthly bibliography of all the reports received in this field by the Prevention of Deterioration Center, is also available for an additional $10 per year.

We Present

Herman G. Schanche: Industrial Executive

WITHOUT question, one of the most notable and encouraging developments in forestry during the past two decades has been the expansion in industrial forest management, in particular by the pulp and paper industry. This movement came not alone by chance or even by favorable economic conditions. It represents the fruition of long years of technical skill, patient planning, and sound leadership by a not numerically large group of private foresters. Strangely enough, despite the truly remarkable extent of their accomplishments, these men are virtually unknown to the profession at large.

One of the leaders in this field is Herman G. Schanche, vice president in charge of woods operations of Brown Company of Berlin, New Hampshire, and of its wholly owned subsidiary, Brown Corporation of Quebec.

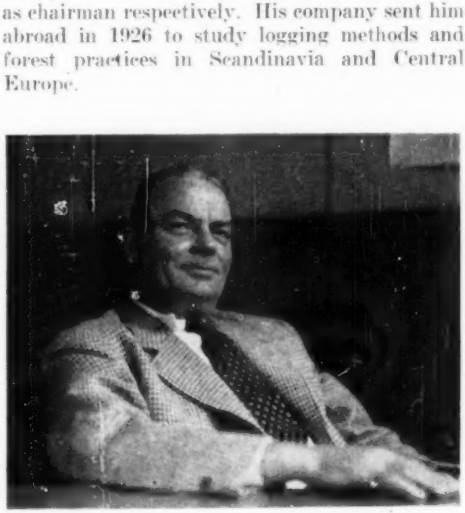
A native of southeastern Pennsylvania, he was graduated in forestry from Penn State in 1918, his college career having been interrupted by a year's employment, under Ellwood Wilson, in the Forestry Department of the Laurentide Company of Grand Mere, Quebec, and by enlistment in the Army Air Service from which he was discharged in 1919 as a lieutenant.

Following military service, he was offered appointment as chief forester for Abitibi Power and Paper Limited, at Iroquois Falls, Ontario. Even in this age of airplanes and radio, the Canadian "bush" of today contains many wild and remote areas. Forty years ago it provided numerous experiences and not a few adventures for this young forester cruising timber far from the beaten track and the city's bright lights, occasionally travelling the wilderness by dog team and living in a tent at fifty below.

During the rise of industrial forestry, some foresters made outstanding records in the technical field. But not all were able to achieve complete application of silviculture because the full support of company management was lacking. As is now widely recognized, greatest progress in private forest management has occurred where professionally trained foresters have occupied executive positions. Such positions are not to be had for the asking. They are usually only obtainable through a demonstrated capacity for ability, skill, hard work, judgment, and integrity, all of which qualities Herman Schanche possesses.

Within a few years after he had organized a Forestry Department for Abitibi, this department was merged with the company's Woods Department of which he was named manager. In 1929 he became general manager of woods operations for the whole company. One may better comprehend the responsibilities and complexities of his position when it is explained that Abitibi at that period operated nine pulp and paper mills extending from Murry Bay in Quebec to north of Winnepeg in Manitoba. The company managed about 33,000 square miles of timberlands and, at the time, had one of the largest pulpwood operations on the continent. Herman Schanche was the first technically trained forester in Canada to occupy such a key industrial position.

In addition to his executive duties, Mr. Schanche found time to take part in public and professional forestry affairs. He was active in the Canadian Society of Forest Engineers; and helped organize the Woodlands Section of the Canadian Pulp and Paper Association, on whose Council he served both as a member for seventeen years and two terms as vice chairman and as chairman respectively. His company sent him abroad in 1926 to study logging methods and forest practices in Scandinavia and Central Europe.



HERMAN G. SCHANCHE

In 1943 Mr. Schanche returned to the States as general manager of woods operations for Brown Company at Berlin, New Hampshire, one of the oldest pulp and paper firms in the Northeast, and of Brown Corporation, its Canadian Subsidiary. In mid-1944 he was appointed vice president in charge of woods operations of the parent company and of its Canadian subsidiary.

Drawing on his Canadian experience, Mr. Schanche has made numerous long range plans for the efficient utilization and management of the company's forest resources. Aerial photographs have been taken of all the woodland tributary to the mills. These photographs have provided the company and its Canadian subsidiary with precise data for making maps, for delineating cover types, for making stumpage inventories by species, and for other useful purposes. Sustained-yield operation has been made possible by the construction of a kraft mill in which species such as pine, cedar, tamarack, and hardwoods, formerly not efficiently utilized, now enter into production. New logging camps with all modern conveniences have been introduced, and under his direction the company has become a leader in the Northeast in developing mechanical logging methods.

Brown Company operates two paper mills, a sulphite pulp mill, a sulphate pulp mill, and an experimental mill in New Hampshire; and in Quebec Brown Corporation operates a sulphate pulp mill. The total annual consumption of pulpwood by these mills is about 610,000 cords.

The woods holdings of the two companies in the United States and Canada total 3,038,000 acres. Employment is given to 18 graduate foresters and several graduate engineers in various capacities.

A leader in the industry at large, Mr. Schanche is a director and a member of the Executive Committee of the American Pulpwood Association, and a member of the Forestry and Pulpwood Committee of the American Paper and Pulp Association. He has been a Senior Member of the Society of American Foresters for more than a quarter-century.

It is no exaggeration to say that Herman Schanche's career, his thirty years of successful managerial experience, have contributed greatly to the spread of industrial forestry. In a very direct sense, his achievement, and that of others with similar accomplishments, is the reason why so many professional foresters are now finding employment in this increasingly forestry-minded industry.

A man of genial personality, Herman Schanche's executive leadership derives from his ability to work with people, from his friendly attitude toward his fellow men, and finally from his faculty for understanding the problems of others.

C. S. HERR,
Member, S.A.F.

Points of View

The Business of Forestry

In the September 1948 issue of *Harvard Business Review*, published in Boston, is an article, "Business Organization for Effective Use of Forest Products," by W. Arnold Hosmer.

The author is professor of accounting, Harvard Business School. In this article he analyzes the problems of forest products-recovery in connection with relatively small-scale stands in the East, the South, and the Lake States, and proposes a new type of business organization.

His first point is that whereas research has been active for forty years in the biological phases of forestry and research on utilization and on methods of recovery is particularly active at present, little research has been done on the business aspects of the subject.

To quote, "The problem that we are considering is that of an industrial operation, similar in many respects to other industries engaged in recovering a natural resource. Its area of operation is from the original cutting in the woods to the sale of lumber and other products, prepared to meet the specifications of customers in the most advantageous market of sale. In accomplishing this purpose a business organization designed to establish a creative atmosphere is more important than any specific technical developments."

He argues for multiple-product recovery (a good phrase, by the way!) whereby all material would be brought to a central mill for processing. He goes on to say, "Management. The real center of such an enterprise would be its management. The executive group should be a team, capable of planning and carrying out operations which integrate (1) the material available, (2) processing at the mill, and (3) the market situation."

Before dismissing the author's views as visionary it is well to reflect that the forest industries have indeed been backward in solving the problems of integrated utilization. It is his argument that the industries need a new type of business organization in the recovery phase; he urges that the driving force of private initiative be used in working out a solution of the problem.

A. B. Recknagel,
St. Regis Paper Company.
Member, S.A.F.

Reviews

The Amateur Naturalist's Handbook. By Vinson Brown. 475 pp. Illus. Little, Brown and Co., Boston. 1948. $3.50.

Since the late war, several useful books on nature study have appeared. This most recent volume is a splendid addition to this field. The author recognizes that not all those interested in nature study possess the same aptitudes and preparation for it. Hence he wisely separates his material into four divisions: for the beginning naturalist, the student naturalist, the advanced naturalist, and the explorer-naturalist.

Mr. Brown has hit on a delightful way of introducing some of the subjects, by explaining them in terms of the great personalities in science who studied plants, animals, rocks, stars, weather, and so forth. His directions for collecting and classifying specimens are clearly set forth, and the illustrations, mainly line drawings by Don Kelley, nicely supplement the text.

The value of the work is enhanced by an index with considerably more words listed than is customary in a book of this kind.

The present reviewer has only one criticism to offer, and though pertinent it is not serious enough to detract from the otherwise excellent contents. In the bibliography, for the most part evidently compiled with care, three books on trees and shrubs are listed, two of which were published prior to 1920 and are in consequence not as up-to-date as more recent reference works in this field.

For any amateur naturalist or any youth cultivating an interest in nature study, this handbook should prove a helpful tool. As a gift to such a person it should be most welcome.

HENRY CLEPPER,
Member, S.A.F.

Forestry in Denmark. By Axel S. Sabroe. 144 pp. Illus. The Danish Forest Society, Copenhagen, Denmark. 1947.

Written in English, *Forestry in Denmark* serves as a guide to visiting foreign foresters. Through it they can obtain a historic background of the forests and information about their management.

The book describes briefly the geographic position and geological and meteorological condition of Denmark. It points out that the rainfall is only between 16 inches and 31.5 inches. With this relatively small precipitation and a rather short growing season of 145-160 days, Danish foresters have been able to achieve growth figures of 200 to 350 cubic feet per acre. This amazing growth is the result of studies which date back more than 150 years when the foresighted statesman and forester C. D. F. Reventlow started the intensive management of beech in Denmark. Through light thinnings made with intervals of 2-5 years and short rotations he was able to develop trees with short but valuable boles and large crowns thereby maintaining a four percent interest rate on the standing volume. This system, which is known all over the world as the crown thinning or Danish thinning, is practiced with local modifications all over Denmark.

The reader will be interested also in studying the site index curves constructed by Prof. C. M. Møller. These curves give for various species and sites the height, annual growth, annual cut, volume, basal area, diameter, number of stems per acre in relation to age.

Throughout the publication there are numerous photographs of forest stands readily showing the intensity with which the various species are treated. Through these illustrations and a well written text this publication gives an excellent picture of the Danish forest condition and leaves the reader thinking about the possibilities which could be developed if similar intensive methods were applied to the more accessible areas in the United States.

TORKEL HOLSOE,
West Virginia University.
Member, S.A.F.

Wildlife Management. By Reuben Edwin Trippensee. 479 pp. McGraw-Hill Book Company, New York. 1948. $5.

Dr. Trippensee has written a textbook which will supplement *Game Management* by Leopold.

Whereas Leopold's book deals largely with fundamental principles, this book presents the findings of research on the management of some of our important game species.

The subtitle of this work is "Upland Game and General Principles"; it is divided into five sections, and in the prefatory statement the author implies that a second volume, which will take up fur-bearers, water fowl, and game species, is in manuscript form. The five sections of this volume are: Farm Wildlife, Forest Wildlife, Wilderness Wildlife, Miscellaneous Wildlife Relationships, and Wildlife Administration. In each of the first three parts, chapters are devoted to the species found in the environment named in the title. The leading chapters in each are devoted to a description of the habitat and the applicable methods of manipulating it.

Some may be disappointed with the proposals of Dr. Trippensee regarding the farm as a wildlife habitat and wildlife management in the forest. In the chapter on "The Farm as a Wildlife Habitat" there is frequent reference to the need for interspersion of the various components of the farm-wildlife habitat. The "edge principle" is also mentioned. There is implied acknowledgement of the usefulness to wildlife of some of the more important farm crops, principally corn and high-quality hay.

One of the best methods of attaining good interspersion of these two highly important cover types is through contour strip farming which has become synonymous with erosion control. This treatment of the land could well have been included here as a formula for land treatment acceptable to farmers and of high value in improving the carrying capacity of the farm for wildlife. As a matter of fact, the complete conservation plan for farms, based on the treatment of land according to its capability to include such practices as shrub borders on woodland edges, contour hedges of woody plants separating pastures, or alternate strips of food-producing cultivated crops and cover-producing hay, shrub and tree plantings on odd areas, revegetation of stream banks with low-growing shrubs to protect the shores against the buffeting of floods, could have been part of this formula. These provide an unusual opportunity for the wildlife manager working with farmland. Furthermore, they are more likely to receive acceptance by farmers who, after all, own this habitat, than food patch plantings, refuges, and the use of flushing bars. In describing these erosion control-wildlife habitat improvements, the author could have been more specific.

In his treatment of wildlife management in the forest, under the subheading of "Administrative Problems," the author states that there are two possible opposing objectives in the management of forests—wood or wildlife. The principles adopted by the Society of American Foresters from the report of the Committee on Multiple Use do not admit this conflict. Good forestry is not necessarily poor wildlife management. The two are compatible and one need not necessarily be subordinate to the other. Perhaps in this respect, the reviewer has misinterpreted the author. This may be a result of the author's scrupulous care to be tolerant of opposing viewpoints.

This tolerant attitude is prevalent in all of the chapters dealing with particular species. The author has thoroughly combed the literature and research in preparing these chapters. Each contains an excellent bibliography, and in each care is used to include conflicting evidence wherever it occurs. Where such conflicts are present it will be left to the teacher or the student to decide which evidence will be useful to him in his particular problem. There are no dogmatic assertions that this is right and that is bad. The organization of the book will be particularly useful to teachers of courses in wildlife management, training foresters, or wildlife managers. The practicing technician will find it a worthwhile reference.

Dr. Trippensee, who is now professor of wildlife management in the Department of Forestry and Wildlife Management at the University of Massachusetts, has made a very substantial contribution to our conservation literature.

RICHARD M. MAY,
Member, S.A.F.

Professional Opportunities in the Wildlife Field. By David B. Turner. Wildlife Management Institute, Washington, D. C., 208 pp. 1948. $1.

Answers to many of the questions confronting a student debating the desirability of entering the fish and wildlife field are found in this study. It is divided into five parts: I Individ-

ual Training, II Institutions, III Federal Employment, IV State and Province Employment, and V General Summary and Conclusions.

Based on investigations conducted in 1945 and 1946, the study is successful in compiling, in readily accessible form, statistics concerning the courses of instruction in fish and wildlife management taught in the 33 U. S. and Canadian schools offering professional training in that field.

Detailed information concerning the number and grades of positions in federal, state, and province conservation organizations gives an accurate picture of their activities at the time of the survey, and the prediction of changes anticipated until 1950 provides prospective wildlifers a fairly good idea of their professional employment possibilities. The expanding, but largely unknown, opportunities for privately or self-employed wildlife specialists are touched upon.

Of primary interest to schools are the results of a survey of practicing fish and wildlife specialists concerning the academic courses deemed most essential to adequate training.

"There is scarcely a phase of fishery or wildlife work today which does not demand public relations ability and participation. Training for this part of the job is obligatory under modern conditions," states Mr. Turner in his summary of findings. That fact, coupled with the concensus of 700 professional wildlife men that a basic group of 26 technical subjects plus at least 10 more specialized technical courses are desirable, makes it apparent that a 4-year course is insufficient adequately to prepare a professional fishery or wildlife student. Graduate work is strongly recommended preparation for most positions.

The evolution of the "catfish cop," or game warden, of heavy hand and wooden head to a professionally t r a i n e d conservation officer charged with promoting cooperation between all sections of the public and the agency he represents, indicates expanded employment opportunities.

Even if it were of no other value, *Professional Opportunities in the Wildlife Field* would be welcomed as an encyclopedia of replies to the never-ending queries: "What are my chances in wildlife work? Where can I obtain training? What courses should I take?"

ROBERT D. HOSTETTER,
Member, S.A.F.

North American Trees. By Richard J. Preston, Jr. 428 pp. 160 plates. Iowa State College Press, Ames. 1948. $4.

Written to meet the need for a field manual as well as a text for classroom use, this handbook covers the trees of North America exclusive of Mexico and the small tropical portion of the United States. And does it very well.

The species treated total 568, of which 232 are considered to be of sufficient importance to warrant plates showing significant characteristics, distribution maps, and descriptions of botanical and silvical features. The remaining 336 species mentioned are considered of less importance and are either only briefly described or included in the complete keys.

Now director of the Division of Forestry at North Carolina State College, Dr. Preston was until last year on the forestry faculty at Colorado A & M College, and is the author of *Rocky Mountain Trees.* A certain emphasis on western species, which is doubtless explained by his previous western associations, is discernible in *North American Trees.* Eastern white pine, for example, is one of the species accorded a somewhat subordinate position by reason of its extremely brief description in comparison with such western species as limber pine and bristlecone pine which are patently less important commercially. In view of the author's experience in this field it is not conceivable that he would curtail the possible use of the manual by undue regional coverage. Hence these remarks are not offered as criticisms against the value of the book, but are simply observations which others too may note in passing.

The vagaries of nomenclature are another matter for which authors of tree books are perhaps not to be too severely criticized. The present reviewer confesses himself not a little confused by the latest system of compounding of tree names, and has just about given up trying to understand the reasons therefor. However, that inconsistencies exist is palpably evident; why is western *redcedar* one word and northern *white-cedar* hyphenated when they are both of the genus Thuja?

The plates, some of which were adapted or reproduced for earlier tree books, are excellent. Although small, the maps showing the ranges of species are most helpful.

In the introduction is a brief description of the several forest regions of America, followed by a discussion of the structural and silvical

characteristics of trees. A key to the genera is included; it appears to be complete without being cumbersome. At the end are a glossary of botanical terms and an index.

All in all, the book provides a new and extensive guide to the identification of our native trees and is a welcome addition to the literature on this subject.

HENRY CLEPPER,
Member, S.A.F.

Current Literature

Compiled by MARTHA MEELIG, *Librarian*
The New York State College of Forestry
Range Management Section Compiled by
FRANCES FLICK, *Library, U. S. Department of Agriculture*

General

Bibliography on Cooperation in Agriculture [includes forestry]. Comp. by H. B. Turner and F. C. Bell. 178 pp. U. S. Dept. Agric. Lib., Washington 25, D. C. 1948 Lib. List No. 41. 85 cents.

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The Land of the Crooked Tree. By U. P. Hedrick. 350 pp. Oxford Univ. Press, New York 11. Oct., 1948. $4.50.

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The Study of Plant Communities; an Introduction to Plant Ecology. By H. J. Oosting. 389 pp. Illus. W. H. Freeman and Co., San Francisco, Calif. 1948. $4.50.

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Strength Tests of Wood Crossarms. By R. C. Eggleston. 38 pp. Illus. Bell Telephone Laboratories, Inc., New York 14. 1948.

Society Affairs

Officers and Members of the Council—1948-1949

CLYDE S. MARTIN, *President*
Weyerhaeuser Timber Company,
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Bureau of Entomology and Plant Quarantine,
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State Commission of Forestry,
Calhoun State Office Building,
Columbia, S. C.

WILLIAM B. GREELEY,
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Brown Company,
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RICHARD E. MCARDLE,
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Washington 25, D. C.

DEWITT NELSON,
Division of Forestry,
Department of Natural Resources,
Sacramento 14, Calif.

JOHN W. SPENCER,
U. S. Forest Service,
Post Office Building,
Denver 2, Colo.

Nine Amendments to Constitution Approved, Including Increase in Dues

In the referendum held by mail ballot last fall, nine amendments to the Constitution of the Society were approved and became effective upon their adoption on November 13, 1948, the date the votes were officially counted.

The amendments, all of which received the necessary approval of two-thirds of the members voting, are published for the information of the membership together with the vote as certified by the tellers, who actually counted every ballot.

The tellers:

W. B. BRANCH,	R. D. HOSTETTER,
W. P. EVERARD,	GEORGE S. KEPHART,
GORDON D. FOX,	GEORGE T. OLSON,
CHAS. M. GENAUX,	GEORGE C. ROMEISER.

Grades of Membership

Article III. Section 1. The membership of the Society shall consist of Junior Members, Members, Fellows, Affiliate Members, Associate Members, Corresponding Members, and Honorary Members.

(The vote on the foregoing section was 2,476 for it; 545 against it.)

Citizenship of Members

Article III. Section 2. Members and Fellows shall be at the time of their election citizens of the United States, its possessions, or Canada. Affiliate Members, Junior Members, and Associate Members shall be, at the time of their nomination for membership, citizens of the above-mentioned countries or shall have declared, in a legally accepted manner, their intention of becoming citizens.

(The vote on the foregoing section was 3,015 for it; 26 against it.)

Grade of Member Defined

Article III. Section 5. Members shall be elected from the Junior Members and shall have had at least three years' experience in forestry subsequent to the date they met the requirements for Junior Membership. Advancement to Member shall indicate that in the opinion of the Council the candidate is possessed of both the requisite theoretical and practical experience and has demonstrated his acceptance of such standards of professional conduct and character as to justify the Society in accepting him as competent to represent the profession honorably and capably in the performance of his duties. Members shall be engaged in forestry work at the time of election.

(The vote on the foregoing section was 2,643 for it; 381 against it.)

Grade of Fellow Defined

Article III. Section 6. Fellows shall be foresters of outstanding achievement as leaders in responsible directive or distinctive individual

work of a fruitful character. They shall be elected from the Members and shall be engaged in forestry work at the time of their election.

(The vote on the foregoing section was 2,602 for it; 374 against it.)

Admission to Membership; Advancement to Member

Article IV. Section 2. Nominations for all grades of membership except Junior Member and Fellow shall be endorsed by a Section of the Society except for candidates not residing within the territory of any Section, when they shall be endorsed by three Members or Fellows; and shall be submitted in writing, with complete evidence of qualifications, to the Executive Secretary.

Nominations for Junior Membership for candidates who are graduates of schools of forestry approved by the Council shall be endorsed by three voting members of the Society or by a Section and shall be submitted with evidence of such graduation to the Executive Secretary.

Nominations for Junior Membership for candidates who are not graduates of schools of forestry approved by the Council shall be endorsed by a Section of the Society and shall be submitted with complete evidence of education and practical experience to the Executive Secretary.

Immediately upon a Junior Member's fulfillment of the requirements for Member, the Section in which he is domiciled may nominate him for the higher grade. A Junior Member who, at the expiration of six years, has not been nominated by a Section for the grade of Member, and who is actively engaged in forestry work, shall automatically become a Member unless his advancement is protested on the basis of lack of competence or for other reasons and the protest is sustained by the Council.

Annually, the Executive Secretary shall notify each Section of every Junior Member in its territory who is completing his sixth year of membership, and shall request a report on him and an endorsement if he is eligible for Member. Instances of questionable eligibility shall be referred to the Council, which body shall interpret the phrase "actively engaged in forestry work" in doubtful cases. Thus those who have been Junior Members for six years, who are actively engaged in forestry work, who have had three years' experience in forestry, and whose advancement is not protested on grounds of competence or for other reasons, shall be certified as full Members by the Council.

(The vote on the foregoing section was 2,681 for it; 360 against it.)

Election of Fellows

Article IV. Section 4. Election to the grade of Fellow shall be concurrent with the election of officers by letter ballot of the members of the Council and Fellows. The ballots may be counted by any system of preferential voting which the Council may prescribe provided each candidate elected thereunder shall be required to receive an affirmative vote of not less than one-half the total votes cast.

(The vote on the foregoing section was 2,715 for it; 280 against it.)

Membership Dues

Article V. Section 2. Effective January 1, 1949 annual membership dues shall be as follows:

For Fellows, $15

For Members, $12 for their first six years in this grade; $15 thereafter.

For Junior Members, $6 for their first three years in this grade; $9 for their second three years in this grade; $12 thereafter.

For Associate and Affiliate Members, $6.

Honorary and Corresponding Members shall not be charged dues.

(The vote on the foregoing section was 2,156 for it; 923 against it.)

Payment of Dues

Article V. Section 3. Annual dues shall be payable from the first day of January. Members in arrears on July 1 shall be declared in bad standing and shall forfeit from that date until their dues are paid, the right to vote, to be elected to office, or to receive the official publications of the Society. Entrance fees and dues of newly elected members shall be payable upon their acceptance of election to membership. Members elected after April 1, July 1, and October 1, respectively shall be charged three-fourths, one-half, or one-fourth of the annual dues for the year as indicated by the date of election except that members admitted to the Society after December 1 shall not be charged dues for the remainder of the calendar year. Members promoted to a higher grade shall be charged with the dues for said grade, beginning with the quarter-year in which they were elected. The Council may remit the dues of any member for any special reason as provided in the bylaws. No member of any grade shall be entitled to any

return of fees or dues upon severance of his connection with the Society.

(The vote on this section was 2,950 for it; 87 against it.)

Sections of the Society

Article XI. Section 1. Sections of the Society may be authorized by the Council upon the written petition of thirty or more voting members, at least fifteen of whom shall be Members or Fellows, resident within a territory small enough to justify the belief that a strong local organization may be effected. Sections must hold at least one meeting each year to retain their authorization.

(The vote on the foregoing section was 2,926 for it; 100 against it.)

Code of Ethics Adopted by Foresters

By mail ballot of the membership of the Society of American Foresters, a code of ethics for the forestry profession was adopted November 13, 1948.

The vote was 2,902 in favor of the proposed code; 136 voted against its adoption; and 12 members returned ballots but did not vote.

These canons of ethics will be broadly construed in the interest of the public welfare and professional advancement.

They will be deemed duties, obligations, and responsibilities of the professional forester to all those with whom he comes into contact in the course of his professional work and life.

They will be construed so as to disregard any differentiation between professional foresters in public or private employ. The standard of professional conduct exacted by these canons of ethics from professional foresters makes no distinction as to place or kind of employment.

Because the canons consider the usual and foreseeable circumstances governing professional conduct only, experience may require modifications or additions.

Canons of Ethics for the Profession of Forestry

The purpose of these canons is to formulate guiding principles of professional conduct for foresters in their relations with each other, with their employers, and with the public. The observance of these canons secures decent and honorable professional and human relationships, establishes enduring mutual confidence and respect, and enables the profession to give its maximum service.

Professional Life

1. The professional forester will utilize his knowledge and skill for the benefit of society. He will cooperate in extending the effectiveness of the forestry profession by interchanging information and experience with other foresters, and by contributing to the work of forestry societies, associations, schools, and publications.

2. He will advertise only in a dignified manner, setting forth in truthful and factual statements the services he is prepared to render for his prospective clients and for the public.

Relations with the Public

3. He will strive for correct and increasing knowledge of forestry and the dissemination of this knowledge, and will discourage and condemn the spreading of untrue, unfair, and exaggerated statements concerning forestry.

4. He will not issue statements, criticism, or arguments on matters connected with public forestry policies without indicating, at the same time, on whose behalf he is acting.

5. When serving as an expert witness on forestry matters, in a public or private fact finding proceeding, he will base his testimony on adequate knowledge of the subject matter, and render his opinion on his own honest convictions.

6. He will refrain from expressing publicly an opinion on a technical subject unless he is informed as to the facts relating thereto, and will not distort or withhold data of a substantial or other nature for the purpose of substantiating a point of view.

Relations with Clients and Employers

7. He will be loyal to his client or to the organization in which he is employed and will faithfully perform his work and assignments.

8. He will present clearly the consequences to be expected from deviations proposed if his professional forestry judgment is overruled by nontechnical authority in cases where he is responsible for the technical adequacy of forestry or related work.

9. He will not voluntarily disclose information concerning the business affairs of his employers, principals, or clients, which they desire to keep confidential, unless express permission is first obtained.

10. He will not, without the full knowledge

and consent of his client or employer, have an interest in any business which may influence his judgment in regard to the work for which he is engaged.

11. He will not, for the same service, accept compensation of any kind, other than from his client, principal, or employer, without full disclosure, knowledge, and consent of all parties concerned.

12. He will engage, or advise his client or employer to engage, other experts and specialists in forestry and related fields whenever the client's or employer's interests would be best served by such actions, and he will cooperate freely with them in their work.

Relations with Professional Foresters

13. He will at all times strive to protect the forestry profession collectively and individually from misrepresentation and misunderstanding.

14. He will aid in safeguarding the profession against the admission to its ranks of persons unqualified because of lack of good moral character or of adequate training.

15. In writing or in speech he will be scrupulous to give full credit to others, in so far as his knowledge goes, for procedures and methods devised or discovered and ideas advanced or aid given.

16. He will not intentionally and without just cause, directly or indirectly, injure the reputation or business of another forester.

17. If he has substantial and convincing evidence of unprofessional conduct of a forester, he will present the information to the proper authority for action.

18. He will not compete with another forester on the basis of charges for work by underbidding through reduction of his quoted fee after being informed of the fee quoted by a competitor.

19. He will not use the advantages of a salaried position to compete unfairly with another forester.

20. He will not attempt to supplant another forester in a particular employment, after becoming aware that the latter has been definitely engaged.

21. He will not review the work of another forester, for the latter's employer, without the other's knowledge, unless the latter's connection with the work has been terminated.

22. He will base all letters of reference or oral recommendation on a fair and unbiased evaluation of the party concerned.

23. To the best of his ability he will support, work for, and adhere to the principles of the merit system of employment.

24. He will not participate in soliciting or collecting financial contributions from subordinates or employees for political purposes.

25. He will uphold the principle of appropriate and adequate compensation for those engaged in forestry work, including those in subordinate positions, as being in the public interest and maintaining the standards of the profession.

Kentucky-Tennessee Section Meets at Kentucky's Cumberland Falls Park

The sixth annual winter meeting of the Kentucky-Tennessee Section convened October 29 at beautiful DuPont Lodge, perched high above the renowned Cumberland River Falls. Included among the 50 persons present were two distinguished visitors—Henry Ward, conservation commissioner of the State of Kentucky, and Tom Wallace, editor emeritus of the *Louisville Times* and Honorary Member of S.A.F. Mr. Ward was the banquet speaker.

Technical papers and special committee reports took up the first day. A. M. Williams presented a case report of the Hassell and Hughes Lumber Company's first five years under sustained-yield management; Henry Sipe reviewed the fire control situation on the Cumberland National Forest; and Robert R. Rider reported on his activities as assistant county agent in forestry for Marshall County, Kentucky. College level forestry instruction within the Section was summarized by O. M. Davenport, and Maxwell MacMaster gave a report on private forestry. Forestry legislation of the past year was reviewed by Harold L. Borden.

At the business meeting, October 30, Willis M. Baker, Council member, reported on the last Council meeting and called attention to the current Constitutional referendum.

Nominees for vice chairman for the coming year are J. O. Artman, H. L. Borden, and Paul A. Yost; nominees for secretary-treasurer are Henry Sipe and O. M. Davenport. W. Paul Bullock becomes chairman by automatic succession from vice chairman. The Executive Committee was authorized to appoint a delegate to the Boston meeting in December, said delegate to be reimbursed to the extent of $100

for expenses incurred. Memphis was selected as the site of the Section's 1949 spring meeting; the winter meeting will be held in Lexington. An effort will be made to hold the Memphis meeting jointly with the Ozark Section and the Memphis Lumberman's Club.

One of several resolution adopted caused much discussion. It is reproduced here for the benefit of those who might want to take some action on it:

WHEREAS the Mammoth Cave National Park contains unique and irreplaceable natural formations which have for many years attracted large numbers of visitors from all over the nation and world; and

WHEREAS the people of Kentucky and neighboring states have a vital interest in assuring that Mammoth Cave be preserved for posterity in its present form and extent; and

WHEREAS the proposed flood control dam downstream from the cave, known as the Mining City Dam, will, if constructed, flood a large part of the surface area of the park and will back water into the famous Echo River portion of the cave—this being one of its primary attractions—thereby seriously detracting from and interfering with public enjoyment of this scenic wonder; now therefore be it

Resolved that each individual member of the Kentucky-Tennessee Section of the Society of American Foresters seriously consider the values at stake; and that, if he is in accord with the above stated premises, he personally express to his Congressional representatives his concern over what appears to be an ill-advised project.

J. O. ARTMAN,
Secretary-Treasurer.

Ohio Foresters Organize Subsection

On October 7 the foresters of Ohio voted to form an Ohio Subsection of the Central States Section of the Society of American Foresters at a meeting held at Camp Muskingum.

The group plans to hold two meetings a year to consider local forestry problems of a technical nature. One of the first projects to be undertaken will be to work out forest practice rules which should be followed in the proper manage-

GROUP ATTENDING KENTUCKY-TENNESSEE SECTION MEETING.

ment of forests in the various cover types which occur in Ohio.

Officers of the subsection are Chairman, Dr. Oliver D. Diller, associate professor of forestry, Ohio State University, and associate forester, Ohio Agricultural Experiment Station, Wooster; Vice Chairman, G. Luther Schnur, forester, Central States Forest Experiment Station, Columbus; Secretary-Treasurer, Jean E. Fisher, forester, New York Coal Company, Jackson.

At the first meeting of the Ohio Subsection a Committee on Forest Cutting Practices was appointed.

The committee consists of Chairman, J. Frank Needham, farm forester, Ohio Division of Forestry, Chillicothe; Dr. Daniel L. Leedy, leader, Ohio Wildlife Research Unit, Ohio State University, Columbus; James K. McBride, forester and sawmill operator, Coal Run; Robert W. Merz, forester, Central States Forest Experiment Station, Athens; James W. Meeteer, assistant forester, Ohio Agricultural Experiment Station, Wooster; and H. R. Moore, associate economist, Ohio Agricultural Experiment Station, Columbus.

More on S.A.F. Membership Qualifications

Salt Lake City, Utah,
November 10, 1948.

Dear President Martin:

Your letter of October 11 to Lincoln Ellison, chairman of the Division of Range Management, was read and discussed in the meeting of the Intermountain Section on October 20.

In your letter you comment on my letter of August 13 to council members in which I presented views of the Intermountain Section regarding the basis for Junior Membership. After reading your letter of October 11, it is realized that some misunderstanding has arisen. This is due, I am sure, to the wording of my letter. It was prepared in some haste, in order to make it available for the October issue of the *Journal*. Actually it is not clear on the points you raise. The suggestion in the fifth paragraph of your letter to Ellison contains an important thought which I intended to convey in the following paragraph from my August 13 letter:

"It has long been clear that forestry deals with the water, timber, forage, wildlife, recreation, and soil resources of forested lands and of intermingled or nearby wild lands of other cover types, the management of which should be integrated. Forestry involves the functional activities of protection, development, utilization, management, teaching, and research. Thus, forestry requires the combined services of professional men from many scientific fields. Such professionally trained men should be eligible for Society membership, especially when engaged on a career basis by an organization dealing with wildland resources and problems."

In light of the Section's discussion, I would substitute the following sentence for the last one quoted above: "Such professionally trained men should be eligible for Society membership when engaged on a career basis by an organization dealing with forestry and other wildland resource problems." It should be clear when this is done that we of the Intermountain Section agree with you. I regret that this thought was not carried forward into the next paragraph of my letter after the one quoted above. I would like to amend the second alternative to read:

"(2) Shall (Junior) Membership be open to persons employed by an organization dealing with forestry problems who have professional training in other phases of wildland management equivalent to the training required of an approved forest school graduate?"

I am sending a copy of this letter to Mr. Clepper. I would appreciate having this change published in "Society Affairs" in order that the membership as a whole may know what Intermountain Section opinion is regarding this question.

JOE A. LIBBY, *Chairman,*
Intermountain Section.

November 12, 1948.

Dear Joe Libby:

Fortunately, we are going to have ample time for discussion of this membership qualifications question as Henry Clepper does not believe we can hold another referendum before next October.

I believe that I understand the Intermountain viewpoint on this question with the exception of one detail. As an individual I would go along with your thinking insofar as your amended (2) with one addition. That your range man, soil scientist, recreationist or whatever his special training might have been, should have at least three years experience with his career forestry organization in order that he fully understands the integration of his special field with

the over-all forest problems. I do not believe that a scientific degree alone qualifies a man to be called a forester. He might join a forestry organization, but leave it after a few months for other work and still have no valid claim to be a forester or a member of the Society. On the other hand, many range men, pathologists, entomologists and others are among our most highly regarded foresters, but their knowledge of forestry has been gained through their work and relationship with forestry organizations and problems.

This is a knotty question and will cause much debate.

CLYDE MARTIN,
President.

Coming Events

Southeastern Section

The winter meeting of the Southeastern Section will be held at Gainesville, Fla. January 7 and 8.

The Section chairman is Dr. E. A. Ziegler, School of Forestry, University of Florida, Gainesville.

Southwestern Section

A meeting of the Southwestern Section will be held at the Santa Rita Experimental Range near Tucson, Ariz. in the latter part of February.

The program will be built around range research and management.

Information as to the exact dates and place of the meeting may be obtained from Roger D. Morris, secretary, U. S. Forest Service, Post Office Building, Tucson, Ariz. The chairman of the Section is Wiliam Zeh, Indian Service, Phoenix, Ariz.

Southern Pulpwood Association

The winter meeting of the Southern Pulpwood Conservation Association will be held on February 9 at the Atlanta Biltmore Hotel, Atlanta, Ga.

For information about the program write to Henry Malsberger, the association's forester, First National Bank Building, Atlanta 3.

Wildlife Conference

The 14th North American Wildlife Conference will be held in Washington, D. C., March 7-9, at the Statler Hotel.

Information about the program may be obtained from the Wildlife Management Institute, Investment Building, Washington 5, D. C.

Announcement of Candidates for Membership

The following names of candidates for membership are referred to the membership for comment or protest. The list includes all nominations received since the publication of the December JOURNAL without question as to eligibility. Names, addresses, education, and endorsements are given. The names have not been passed upon by the Council. Important information regarding the qualifications on any candidate which will enable the Council to take final action with a knowledge of essential facts should be submitted before February 15, 1949. Statements on different men should be submitted on different sheets. Communications relating to candidates are considered as strictly confidential.

Allegheny

Junior Membership

Brooks, Ray O., Farm Forester, Dept. of Forests and Waters, Harrisburg, Pa.; Pa. State, B.S.F., 1938. S. L. Kurtz, J. N. Morton, R. E. Chamberlin.

Marra, J. A., County Forester, Cons. Comm. of W. Va., Charleston, W. Va.; Univ. of W. Va., B.S.F., 1947. W. C. Percival, M. Brooks, T. Holsoe.

Stiteler, W. M., Dist. Rgr., U.S.F.S., Elkins, W. Va.; Pa. State, B.S.F., 1948. P. J. Hanlon, H. C. Frayer, A. A. Wood.

Wentz, W. W., Forester, U.S.F.S., Warren, Pa.; Pa. State, B.S.F., 1946. L. E. Stotz, C. L. Kinney, A. H. Anderson.

Senior Membership

Simmons, F. C., Spec., N. E. Forest. Exp. Sta., Upper Darby, Pa.; Cornell Univ., B.S.F., 1928; Yale, M.F., 1931. Reinstatement.

Appalachian

Junior Membership

Cox, G. S., Research Asst., Duke Univ., Durham, N. C.; Duke, M.F., 1948. T. S. Coile, F. X. Schumacher, C. F. Korstian.

Herlevick, V. W., Asst. Dist. Forester, N. C. Dept. of Cons., Fayetteville, N. C.; N. C. State, B.S.F., 1948. L. Wyman, J. V. Hofmann, C. M. Kaufman.

Jones, W. D., Dist. Chief Fire Warden, Va. Forest Service, Williamsburg, Va.; Univ. of Idaho, B.S., (Forestry), 1942. Reinstatement.

Pomerening, D. A., Forestry Research, U.S.F.S., Charleston, S. C.; Univ. of Mich., B.S.F., 1948. T. Lotti, S. H. Buehling, L. E. Chaiken.

Central Rocky Mountain

Junior Membership

Fischer, R. F., Forester, U.S.F.S., Ft. Collins, Colo.; Univ. of Me., B.S.F., 1948. A. G. Randall, H. A. Plummer, R. I. Ashman.

Senior Membership

Helmick, K. J., Cons. Forester, Fort Collins, Colo.; Central Rocky Mountain (Jr. member, 1935).

Hill, M. R., Forester, U.S.F.S., Deadwood, S. Dak.; Pa. State, B.S.F., 1940; Harvard, M.F., 1948. Central Rocky Mountain (Jr. member, 1940).

McGinnies, W. G., Director, Rocky Mt. Forest & Range Exp. Sta., Fort Collins, Colo.; Univ. of Ariz., B.S.A., 1922; Univ. of Chicago, Ph.D., 1932. Central Rocky Mountain (Jr. member, 1945).

Central States

Junior Membership

Bozett, W. J., Jr., Rgr., Ohio Agric. Expt. Sta., Wellington, Ohio; W. Va. Univ., B.S.F., 1947. W. C. Percival, J. B. Byers, E. H. Tryon.

Peck, H H., Asst. Forester, Ohio Agric. Exp. Sta., Wooster, Ohio. Reinstatement.

Columbia River

Junior Membership

Brogan, P. D., Tech. Asst., Clackamas-Marion Counties Fire Control Assoc., Molalla, Ore.; Oregon State, B.S.F., 1948. R. F. Keniston, W. F. McCulloch, G. H. Barnes.

Burniskey, A. T., Forester, Klamath Indian Agency, Klamath Agency, Oregon; Pa. State, B.S.F., 1948. H. H. Chisman, H. N. Cope, V. Beede.

Watson, J. B., Forester, U.S.F.S, Prineville, Ore; Univ. of Calif., B.S.F., 1948. J. L. Wahrgren, H. C. Fosberg, F. E. Lound.

Wetzel, W. W., Forester, U.S.F.S., Portland, Ore. Reinstatement.

Gulf States

Junior Membership

Donaldson, D. J., Jr., Forester, Kirby Lbr. Corp., Houston, Texas; La. State, B.S.F., 1948. R. W. Hayes, A. B. Crow, R. F. West.

Pierce, J. L., Dist. Forester, Masonite Corp., Laurel, Miss.; Univ. of Ga., B.S.F., 1948. J. M. Vardaman, B. C. Meadows, J. B. Toler.

Senior Membership

Chatfield, E. E., Forester, Masonite Corp., Laurel, Miss.; N. C. State, B.S.F., 1934. Gulf States (Jr. member, 1934).

Vardaman, J. M., Industrial Forester, Hobae Veneer & Lbr. Co., Inc., Caruthersville, Mo.; Univ. of Mich., B.S.F., 1942. Gulf States (Jr. member, 1944).

Intermountain

Junior Membership

Grossenbach, P. A., Forester, U.S.F.S., Ogden, Utah; Utah State, B.S., (Forestry), 1936. Reinstatement.

Lewis, J. G., Asst. Chief Park Rgr., Natl. Park Service, Bryce Canyon Natl. Park, Utah. Intermountain.

Senior Membership

Groves, B. V., Dist. Forest Rgr., Wasatch Natl. Forest, Salt Lake City, Utah; Univ. of Idaho, B.S., (Forestry), 1937. Intermountain (Jr. member, 1937).

McMaster, W. C., Cons. Forester, Tenn. Valley Forest Mgrs., Inc., Athens, Tenn.; Univ. of Mich., B.S.F., 1938. Kentucky-Tennessee (Jr. member, 1940R47).

Nietzold, G. E., Forester, Cumberland Natl. Forest, Winchester, Ky.; Univ. of Idaho, B.S., (Forestry), 1940. Kentucky-Tennessee (Jr. member, 1942).

New England

Affiliate Membership

Bradeen, C. R., Forester, Penobscot Development Co., Great Works, Me. New England.

Churchill, P. W., Asst. to Vice Pres., Woods Operations, Brown Co., Berlin, N. H.; Dartmouth, B.A., 1907. New England.

Glasgow, J. A., Forester Asst., Penobscot Purchasing Co., Great Works, Me. New England.

Associate Membership

Harris, C. R., Mgr., St. Anne Power Co., Montmorency, P.Q., Canada. New England.

Junior Membership

Cohen, A. J., Student, Yale, New Haven, Conn.; Univ. of Me., B.S.F., 1948. A. G. Randall, H. A. Plummer, R. I. Ashman.

Coville, S. B., Resident Forester, New England Forestry Foundation, Greenfield, N. H.; Pa. State B.S.F., 1928. M. H. Chalfen, H. Baldwin, J. H. Foster.

Rice, W. W., Student, Yale, New Haven, Conn.; Univ of Me., B.S.F., 1948. F. K. Beyer, G. Baker, R. I. Ashman.

Strees, L. V., Party Chief, Int. Paper Co., Chisholm, Me.; N. Y. State, B.S.F., 1948. L. P. Plumley, P. F. Graves, F. E. Carlson.

New York

Junior Membership

Anderson, R. H., Cons. Investigator, N. Y. State Cons. Dept., Albany, N. Y.; Univ. of Mich., B.S.F., 1947. E. W. Littlefield, E. H. Huber, D. B. Cook.

Tefft, L. J., Forest General Foreman, N. Y. State Cons. Dept., Norwich, N. Y., New York.

Wardell, F. S., Forester, Int. Paper Co., Glens Falls, N. Y., New York.

Senior Membership

Barrett, J. W., Instructor in Silvic., N. Y. State, Syracuse, N. Y.; Univ. of Mich., B.S.F., 1937; M.F. 1948. New York (Jr. member, 1937R47).

McGowan, I. F., Dist. Rgr., N. Y. State Cons. Dept., Albany, N. Y. New York (Jr. member, 1944).

Sears, E. W., Forester, N. Y. State Cons. Dept., Albany, N. Y.; N. Y. State, B.S.F., 1934. New York (Jr. member, 1934).

Northern California

Affiliate Membership

Kessler, J. S., Assoc. State Forest Rgr., Div. of Forestry, Sacramento, Calif. Northern California.

Junior Membership

Walt, H. R., Asst. to Advisor for Men, Univ. of Calif., Berkeley, Calif.; Univ. of Calif., B.S.F., 1948. E. Fritz, R. A. Cockrell, M. Krueger.

Senior Membership

Johnson, S. S., Owner, S. S. Johnson Co., Berkeley, Calif.; Univ. of Calif., B.S.F., 1934. Northern California (Jr. member, 1938).

Marsh, R. B., Fire Control Asst., U.S.F.S., Weaverville, Calif.; Univ. of Calif., B.S.F., 1943. Northern California (Jr. member, 1943).

McLeese, K. C., Forester, Sierra Natl. Forest, North Fork, Calif.; Univ. of Calif., B.S.F., 1932. Northern California (Jr. member, 1933).

Mitchell, J. N., Jr., Forester, Bur. of Entom. and Plant Quar., Berkeley, Calif.; Purdue Univ., B.S.F., 1931; Univ. of Calif., M.S.F., 1935. Reinstatement.

Otto, A. W., Supv., Cutting and Logging Operations, Assoc. Lbr. & Box Co., North Fork, Calif.; N. Y. State, B.S.F., 1938. Northern California (Jr. member, 1939).

Schlobohm, D. F., Forest Tech., Calif. Div. of Forestry, Fresno, Calif.; Univ. of Calif., B.S.F., 1934; M.F., 1947. Northern California (Jr. member, 1934).

Winkelman, H. G., Salesman, J. E. Higgins Lbr. Co., San Francisco, Calif.; Univ. of Calif., B.S.F., 1935. Northern California (Jr. member, 1935).

Zivnuska, J. A., Instr., Univ. of Calif., Berkeley, Calif.; Univ. of Calif., B.S.F., 1938; M.F., 1940; Univ. of Minn., Ph.D., (Agric. Economics), 1947. Northern California (Jr. member, 1938).

Northern Rocky Mountain

Junior Membership

Warren, C. J., Woods Supt., Wineglass Ranch Inc., Seeley Lake, Mont.; Mont. State, B.S., (Forestry Engr.), 1941. K. P. Davis, O. M. Patten, J. P. Drummond.

Senior Membership

Haines, A. L., Engr., Natl. Park Service, Yellowstone Park, Wyo.; Univ. of Wash., B.S.F., 1938. Northern Rocky Mountain (Jr. member, 1938).

Ozark

Junior Membership

Arlen, W. H., Forester, U.S.F.S., Hot Springs, Ark.; Iowa State, B.S.F., 1948. J. L. Averell, D. W. Thorsen, M. B. Ricker.

Pomeroy, L. K., Partner, Pomeroy & McGowin, Forest Mgrs., Wilmar, Ark.; Univ. of Wisc., (3 yrs.). Ozark.

Senior Membership

Condit, G. R., Dist. Forester, Crossett Lbr. Co., Crossett, Ark.; Univ. of Minn., B.S.F., 1940; Yale, M.F., 1941. Ozark (Jr. member, 1941).

Johnson, E. W., Assoc. Silvic., U. S. Southern Great Plains Field Sta., Woodward, Okla.; Colo. A. & M., B.S.F., 1926. Ozark (Jr. member, 1933).

Stradt, G. H., Asst. Forest Supv., U.S.F.S., Atlanta, Ga.; Iowa State, B.S.F., 1934. Ozark (Jr. member, 1936R47).

Puget Sound

Affiliate Membership

Kirk, F. R., Partner, G. R. Kirk Co., Tacoma, Wash.; Univ. of Wash, B.A., 1930. Puget Sound.

Senior Membership

Twerdal, M. P., Student, Yale School of Forestry, New Haven, Conn. (On leave from U.S.F.S., Portland, Ore.); Univ. of Wash., B.S.F., 1935; M.F., 1936. Puget Sound (Jr. member, 1936).

Southeastern

Junior Membership

Harley, Ben R., Field Asst., Int. Paper Co., Georgetown, S. C.; N. C. State, B.S.F., 1940. J. V. Hofmann, W. D. Miller, G. K. Sloeum.

Southern California

Junior Membership

Hughes, R. T., Jr. Forester, U.S.F.S., Pasadena, Calif.; Univ. of Calif., B.S.F., 1948. G. Juhren, J. E. Pemberton, R. H. Parsons.

Southwestern

Junior Membership

Cravens, J. H., Forester, U.S.F.S., Williams, Ariz.; Colo. A. & M., B.S.F., 1947; M.F., 1948. C. O. Lindh, A. A. McCutchen, L. J. Putsch.

Elsbree, C. C., Asst. Dist. Forest Rgr., Carson Natl. Forest, Taos, N. Mex.; Pa. State, B.S.F., 1938. Reinstatement.

Jackson, Robert H., Jr. Forester, Coconino Natl. Forest, Flagstaff, Ariz.; Iowa State, B.S.F., 1947. W. H. Zeh, G. S. Meagher, R. D. Morris.

Neumann, P. O., Forester, U.S.F.S., Springerville, Ariz.; Colo. A. & M., B.S.F., 1946. C. O. Lindh, A. A. McCutchen, L. J. Putsch.

Roggie, R. J., Forester, U.S.F.S., Silver City, N. Mex.; N. Y. State, B.S.F., 1943. C. O. Lindh, A. A. McCutchen, L. J. Putsch.

Shields, C. A., Forester, Coconino Natl. Forest, Flagstaff, Ariz.; Colo. A. & M., B.S.F., 1947; M.F., 1948. R. Rothy, F. H. Berry, K. O. Wilson.

Weeden, N. P., Asst. Forest Rgr., U.S.F.S., Albuquerque, N. Mex.; Colo. A. & M., B.S., (Forestry), 1942. C. O. Lindh, A. A. McCutchen, L. J. Putsch.

Senior Membership

Kennedy, W. J., Dist. Park Rgr., Grand Canyon Natl. Park, Grand Canyon, Ariz.; Univ. of Wash., B.S.F., 1932. Southwestern (Jr. member, 1936).

Upper Mississippi Valley

Senior Membership

St. Amant, P. J., Forester, U.S.F.S., Cass Lake, Minn.; Univ. of Minn., B.S.F., 1931 Upper Mississippi Valley (Jr. member, 1944).

Vaux, C. H., Assoc. Prof. of Forestry, Univ. of Minn., St. Paul, Minn.; Colo. A. & M., B.S.F., 1921; Univ. of Wash., M.F., 1936. Reinstatement.

Ziminski, H. V., Forester, Chippewa Natl. Forest, Cass Lake, Minn.; Univ. of Idaho, B.S., (Forestry), 1935. Upper Mississippi Valley (Jr. member, 1935).

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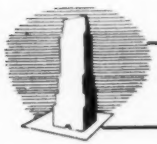

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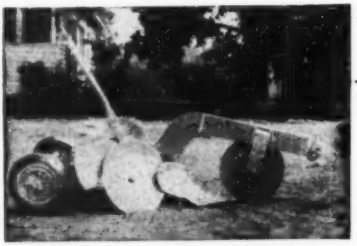

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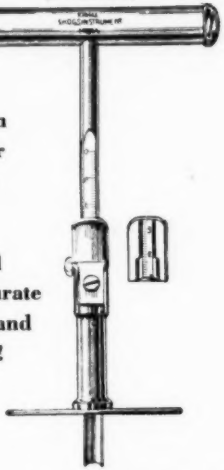

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